

# **Report on the Comparison of Order Executions Across Equity Market Structures**



**Office of Economic Analysis  
United States Securities and Exchange Commission**

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## Executive Summary

### Background

This Report on the Comparison of Order Executions Across Equity Market Structures, prepared by the Commission's Office of Economic Analysis, is part of the Commission's ongoing inquiry into market fragmentation and its possible effects on the quality of execution of investor orders in the National Market System. The Report considers whether order executions differ in markets with differing levels of fragmentation and customer order interaction. It compares the executions of customer orders in securities listed on Nasdaq (a relatively fragmented, primarily dealer market structure) to the executions of customer orders in NYSE-listed securities that are routed to the NYSE (a primarily agency/auction market center that handles approximately 80% of trading volume in these securities).

The Report uses customer order data, which has only recently come available for Nasdaq securities. This enables accurate calculation of effective and realized spreads and order execution speeds, and also allows separate analysis of different types of orders. For the most part, the Report uses measures that will soon be available directly from market centers under Securities Exchange Act Rule 11Ac1-5 -- the Commission's recently adopted Execution Quality Disclosure Rule.

Obviously, any comparative analysis of market structures is necessarily complex. In spite of the fact that every attempt has been made to design the tests and present the results in a clear and unbiased manner, there are three important caveats that should be carefully considered by anyone reviewing this Report:

- There is no single, all-encompassing measure of execution quality. For example, although effective spread is an important component, some investors may prefer a fast execution at a guaranteed price (often available for small orders in Nasdaq securities at dealer market centers) to a slower execution with the possibility of price improvement (often available for small orders on the NYSE). In addition, effective spread measures the handling of a single trade, without considering the ability of a market structure to absorb a series of trades with minimal price volatility.
- Due to feasibility considerations, the size of the sample is somewhat limited. The one-week period of June 5, 2000 to June 9, 2000 covers a single, relatively tranquil episode that followed a period of higher stress and volatility. The results may differ under a different set of circumstances.
- Although the Report uses both matched-sample and regression techniques to try to control for the differences between the stocks that are listed on Nasdaq and the NYSE, these controls can never be perfect. Thus, there is always the possibility that the reported results are driven by remaining differences between the stocks rather than by differences in the degree of order interaction between the two market structures.

## Methods

The results are separately calculated for four categories of Nasdaq stocks:

- 1) A group of the very largest Nasdaq stocks in terms of trading volume and market capitalization, as specifically selected by Nasdaq
- 2) A random sample of Nasdaq stocks with market capitalization over \$1 billion
- 3) A random sample of Nasdaq stocks with market capitalization between \$200 million and \$1 billion
- 4) A random sample of Nasdaq stocks with market capitalization less than \$200 million

For easy reference throughout the Report, these categories are referred to as “very large”, “large,” “middle,” and “small,” respectively.

In selecting the stocks for the Report, some initial filters were applied to ensure the availability of adequate historical information. The data in the report include customer orders for the week of June 5-9, 2000 taken from the Order Audit Trail System (OATS). These orders are for a total of 221 Nasdaq stocks, 25 of which were specifically selected by Nasdaq as being their top stocks in terms of trading volume and market capitalization (the very large category). The Commission staff selected the remaining 196 Nasdaq stocks by taking a random sample of Nasdaq stocks stratified by dollar trading volume. The Report includes data from the System Order Data (SOD) file for all 1141 NYSE stocks that pass the same initial filters used to construct the Nasdaq sample.

The Report includes a “matched pair” analysis that compares order executions in Nasdaq-listed stocks to NYSE order executions in NYSE-listed stocks, where the stocks in each pair have similar market capitalization, share price, return volatility and trading volume. For each measure, the first test uses only the 58 pairs that have the smallest aggregate differences across the four criteria. This analysis is complemented and confirmed by eleven other tests that use larger samples and use regression techniques to control for differences in these and other features. Seven of these tests rely entirely on regression techniques to make comparisons across the two samples, without any need to consider specific matched pairs.

The average market capitalizations for these 58 matched pairs of Nasdaq and NYSE-listed stocks are shown below, broken down by category.

### **Market Capitalizations for Matched Pairs**

	Issuer Size Category			
	Very Large	Large	Middle	Small
Number of Pairs (58 total)	5	14	26	13
<u>Market Capitalizations (millions)</u>				
Nasdaq stocks	50,115	3,330	447	144
NYSE stocks	45,349	3,434	501	169

## Results

The Report includes a variety of measures of order executions, including effective spread, realized spread, quoted spread, speed of execution, and rate of execution. This summary focuses on effective and realized spread for small market orders, and on speed of execution for market orders.

The effective spread measures the execution cost paid by investors by comparing the execution price to the midpoint of the NBBO quoted spread at the time that the order arrived at the market center for execution. These cost differences are doubled in order to make the effective spread statistics comparable to quoted spreads. For example, if a buy order arrives when the spread midpoint is \$20 per share and the buyer pays \$20.125 per share, the effective spread is  $(20.125 - 20) \times 2$ , which equals \$.25 per share.

The Report finds that, for market orders of 100-499 shares in the very large category of matched Nasdaq and NYSE stocks, the average effective spreads are nearly equal. (Although the first matched-pairs test for this category shows Nasdaq effective spreads lower than NYSE effective spreads by 1.2 cents per share, this estimate is statistically insignificant and the results are mixed across the range of the tests.) For 100-499 share market orders in the large, middle and small categories, the first matched-pairs test shows that the average Nasdaq effective spreads are from 5.7 to 11 cents per share wider than those for the matched NYSE stocks. (These differences are statistically significant and consistent across the range of tests).

The higher effective spreads for 100-499 share Nasdaq market orders, for all but the very large stocks, arguably might be explained by more difficult order flow. In other words, the dealers or other traders who are supplying liquidity on Nasdaq might be forced to charge wider effective spreads to protect themselves against a high proportion of informed trades included in the market orders. To test this possibility, we also examine realized spreads. The realized spread is similar to the effective spread, except that it uses the midpoint of the NBBO quoted spread five minutes after the order was executed. As its name implies, the realized spread is a very short-term proxy for the potential profit realized by the dealer or other trader taking the other side of the order. For market orders of 100-499 shares, the Report finds that average realized spreads are nearly equal for the very large matched Nasdaq and NYSE stocks. In the large, middle and small categories, the average Nasdaq realized spreads for 100-499 share market orders are 6.8 to 14.6 cents per share wider than those for the matched NYSE stocks. These results suggest that the higher effective spreads on Nasdaq are not a result of more difficult order flow.

The following table summarizes the results discussed above for 100-499 share market orders, using the first test based on the 58 closest matches. Tables 6 and 9 in the Report show that the other eleven tests produce substantially similar results.

**Effective and Realized Spreads for 100-499 Share Market Orders**

	Issuer Size Category			
	Very Large	Large	Middle	Small
<u>Dollar Effective Spreads</u>				
Average Across Nasdaq Stocks	0.071	0.150	0.206	0.164
Average Across NYSE Stocks	0.083	0.093	0.097	0.088
Difference	-0.012	0.057 **	0.110 ***	0.076 *
<u>Dollar Realized Spreads</u>				
Average Across Nasdaq Stocks	0.025	0.081	0.177	0.155
Average Across NYSE Stocks	0.025	0.013	0.028	0.048
Difference	0	0.068 **	0.149 ***	0.107 ***

\*, \*\*, and \*\*\* denote statistical significance at the 10%, 5%, and 1% levels, respectively

To provide a comparison with the effective spreads paid by investors, the Report also examines quoted spreads. In the very large category, the Report finds that quoted spreads on Nasdaq stocks are on average 5.4 cents per share narrower than quoted spreads for the matched NYSE stocks. Comparing quoted spreads to effective spreads suggests that in Nasdaq stocks many orders are executed at the quotes, whereas many orders sent to the NYSE are executed at better prices inside the quotes. The NYSE rules require that the orders be given the opportunity to interact with other orders, which can result in price improvement. In the large and small categories, quoted spreads are nearly equal across the two markets, whereas the average Nasdaq quoted spreads are somewhat wider in the middle category. As is the case for the very large stocks, the Nasdaq quoted spreads for the other three categories are roughly equal to the effective spreads, whereas the effective spreads for small market orders sent to the NYSE reflect substantial price improvement.

**NBBO Quoted Spreads**

	Issuer Size Category			
	Very Large	Large	Middle	Small
Average Across Nasdaq Stocks	0.079	0.149	0.211	0.154
Average Across NYSE Stocks	0.133	0.148	0.157	0.138
Difference	-0.054 **	0.001	0.053 **	0.016

\* and \*\* denote statistical significance at the 10% and 5% levels, respectively

The Report finds that market order executions are generally faster on Nasdaq than on the NYSE for 100-499 share orders. The difference disappears for the 500-1999 share market orders. Our results indicate that the NYSE executions tend to be somewhat faster than the Nasdaq executions for 2000-4999 share market orders, but Nasdaq believes that many large “not held” orders are not properly identified in their system. This miscoding may reduce the accuracy of the comparison between the two markets for the largest category of orders. The following Table shows the results for the first matched-pairs test. As shown on Tables 19-21 of the Report, the other tests yield similar results.

### Execution Times in Seconds

	Issuer Size Category			
	Very Large	Large	Middle	Small
<u>100-499 Share Market Orders</u>				
Average Across Nasdaq Stocks	3.4	6.0	7.8	4.5
Average Across NYSE Stocks	17.1	15.8	26.5	15.8
Difference	-13.7 ***	-9.8 ***	-18.7 ***	-11.3 ***
<u>500-1999 Share Market Orders</u>				
Average Across Nasdaq Stocks	17.3	24.0	25.0	16.8
Average Across NYSE Stocks	20.6	17.4	27.9	20.6
Difference	-3.3	6.6 **	-2.9	-3.8
<u>2000-4999 Share Market Orders</u>				
Average Across Nasdaq Stocks	53.2	73.3	91.4	72.9
Average Across NYSE Stocks	24.3	28.1	50.2	25.6
Difference	29.0 *	45.2 ***	41.2	47.3 **

\*, \*\*, and \*\*\* denote statistical significance at the 10%, 5%, and 1% levels, respectively

## Report on the Comparison of Order Executions Across Equity Market Structures

### I. Introduction

The objective of this study of equity market trading is to examine differences in order execution cost across different market structures. The study arises out of the Commission's extended inquiry into market fragmentation – the trading of investor orders in multiple locations without interaction among those orders.<sup>1</sup> In today's markets, investor order flow in the same security can be divided among many different "market centers." These different market centers can be broadly grouped into two market structures – listed (NYSE and AMEX) and Nasdaq. The two market structures differ significantly in the extent to which trading is fragmented among separate market centers.

Under the listed market structure, a substantial majority of trading in listed securities (approximately 80% of share volume on the NYSE and 70% on Amex) is consolidated in a single market center -- the primary exchange. The remaining 20-30% of total listed share volume, consisting primarily of smaller size orders, is split widely among the regional exchanges and "third market" market makers. The primary exchanges generally operate agency auction markets that offer a substantial opportunity for direct interaction among investor orders without the participation of a dealer.<sup>2</sup> Dealers (specialists) participate in a relatively small percentage of trading on the primary exchanges (26.8% of volume on the NYSE<sup>3</sup>).

Under the Nasdaq market structure, in contrast, no single market center accounts for a majority of trading in Nasdaq securities. Instead, order flow during regular trading hours is divided among many different market makers, eight ECNs, and a regional exchange. In September 2000, for example, there were an average of 59 market makers per issue in the top 1% of Nasdaq stocks by trading volume, 29 market makers per issue in the next 9% of stocks, and an overall average of 13 market makers per issue. No single market center of any type accounted for more than 15% of the total share volume in Nasdaq securities. In addition, the majority of Nasdaq trading occurs primarily at dealer market centers. The agency markets operated by the eight ECNs collectively accounted for only 25.8% of Nasdaq share volume in September 2000.

In sum, the listed market structure is significantly less fragmented than the Nasdaq market structure for two reasons. First, a significant majority of total trading in listed securities occurs on a primary exchange. Second, the primary exchanges are

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<sup>1</sup> See Securities Exchange Act Release No. 42450 (February 23, 2000), 65 FR 10577 ("Fragmentation Concept Release"); Securities Exchange Act Release No. 43084 (July 28, 2000), 65 FR 48406 (proposing rules for disclosure of order routing and execution practices); Securities Exchange Act Release No. 43590 (Nov. 17, 2000), 65 FR 75414 (adopting rules for disclosure of order routing and execution practices).

<sup>2</sup> Section 11A of the Securities Exchange Act of 1934 provides that an opportunity for investor orders to be executed without the participation of a dealer is one of the five principal objectives for the national market system.

<sup>3</sup> Reflects June 2000. Provided by the NYSE.

predominantly agency markets in which investors' orders interact directly. In contrast, no single market center accounts for a majority of Nasdaq trading, and most of the trading is done with dealers with relatively little interaction between customer orders.

One of the most important concerns prompting the Commission's inquiry into fragmentation was the potential for increased fragmentation of trading in exchange-listed equities, particularly due to dealer practices such as internalization and payment for order flow.<sup>4</sup> This study compares trading in securities with a single, dominant market center with a high degree of order interaction (the NYSE)<sup>5</sup> with trading in securities in a market structure that is divided among many different market centers (all market centers trading Nasdaq securities). This analysis is intended to shed light on how these different market structures affect the execution of customer orders.

## II. Background

As shown in Appendix A, several academic studies have examined execution cost differences between the NYSE and the Nasdaq. For the most part, these studies have focused on effective spread,<sup>6</sup> rather than quoted spread because the effective spread reflects prices actually paid or received by customers. Broadly speaking, these studies concluded that the NYSE had significantly lower effective spreads than the Nasdaq prior to the implementation of the Order Handling Rules. After the implementation of the rules, the results of the comparison are more mixed, but the studies generally seem to indicate effective spreads on the NYSE are still somewhat lower than on Nasdaq. Virtually all of these studies are based on trade data rather than order data, so they are unable to determine the direction of each incoming order,<sup>7</sup> and they are unable to determine the time that each order arrived. Together, these two problems can lead to serious bias in calculating effective spreads.<sup>8</sup>

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<sup>4</sup> See Fragmentation Concept Release, note 1 above.

<sup>5</sup> To highlight the potential market structure effects of order interaction versus fragmentation, only NYSE trading in listed securities is examined. The Commission's staff previously has examined the extent to which execution cost can vary across different market centers trading listed securities. Report on the Practice of Preferencing (April 11, 1997).

<sup>6</sup> For buy orders, effective spread equals twice the amount that the trade price is above quote midpoint. For sell orders, effective spread equals twice the amount the trade price is below the quote midpoint. Thus, if all buy orders paid the ask and all sell orders received the bid, then the effective spread would be the same as the quoted spread. When some orders receive price improvement, the average effective spread is less than the average quoted spread.

<sup>7</sup> Direction of the order means whether the order is to buy or sell shares.

<sup>8</sup> Ideally, the effective spread measures the signed difference between the execution price and the midpoint of the NBBO at the time the order arrived. Studies that have access to only quotes and execution reports are forced to use the quote at the time of the execution report and to infer the direction of the order by comparing the execution price to the quote midpoint. This causes the following errors in inference: 1) The quotes may have moved between the arrival and execution of the order, and 2) buy and sell orders that execute on the other side of the midpoint are assigned an effective spread estimate that has the wrong sign. With unreliable time stamps on the execution reports, the problems above are greatly exacerbated. To understand the kind of problem that can

The lack of order data also means that the previous studies are unable to distinguish trades that resulted from market orders from those that resulted from limit orders, and that they may not accurately measure execution performance for different order sizes when orders are broken up into multiple trades. Further, existing studies are unable to distinguish trades resulting from customer orders from trades between dealers. In contrast, the databases used in this study (described below) allow us to focus on the execution performance of customer orders, by order type and size, excluding all trading between dealers. In addition, since we excluded “Not Held” orders, we are eliminating many trades from institutional customers and focusing primarily on retail customer orders.

Most of the analysis contained in this report uses the same order size categories and definitions of statistical measures contained in the recently adopted execution quality disclosure rule.<sup>9</sup> Accordingly, independent observers will be able to conduct their own comparisons between Nasdaq and NYSE execution cost measures once these statistics become available. The data in the report will provide a useful benchmark reflecting the period prior to the adoption of the rule.

### III. Data for the study

#### A. Sample of stocks

The process for selecting stocks began with all of the US common stocks with share price information in the University of Chicago’s Center for Research in Securities Prices (CRSP) database as of December 31, 1999. We then eliminated stocks that did not have return data beginning December 31, 1997 and all stocks with no information available from the Standard and Poors COMPUSTAT database. We then used the reported intraday volumes and prices from the databases obtained from Securities Industry Automation Corporation (SIAC) and applied several filters to ensure data availability. Finally, we selected a subsample of 200 Nasdaq stocks by sorting our list of 1644 Nasdaq stocks that passed all of the filters by dollar trading volume during January 2000, and then selecting every 8<sup>th</sup> stock from this list.

These filters were originally designed under the assumption that we would obtain data for the 3-month period from February through April of 2000. It turned out, however, that a sample of this size was difficult to obtain from the NASD. In addition, the data files (particularly the NASD audit files) for such a long period would have been very

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arise, imagine accidentally comparing the trades of Qualcomm on Thursday, May 11 (when the stock traded between \$96 and \$101) to the quotes for Monday, May 8 (when the stock traded between \$103 and \$107). The standard methodology for calculating effective spreads would sign all of the May 11 trades as sell orders because the highest trade price of \$101 is still below the lowest May 8 quote midpoint. The effective spread for these presumed sell orders is would be the reference quote midpoint minus the trade price, which would be at least \$2 and could be as high as \$11 based on the price ranges for these two days. Interestingly, just knowing the direction of each order would eliminate the bias in this example provided there were about as many buy and sell orders, although you would still be left with very noisy estimates.

<sup>9</sup> Rule 11Ac1-5.

large and slow to process. After discussions with the NASD, the June 5-9 period was selected. Data were available from this period for all but one of the 200-stock subsample described above, leaving us with a subsample of 199 Nasdaq stocks.

In spite of the fact that data filters described above tended to bias this 199-stock subsample toward the larger issuers,<sup>10</sup> Nasdaq management strongly insisted on full representation of the very largest stocks in the sample. Accordingly, they subsequently transmitted data to the SEC for 31 Nasdaq stocks, which were selected because they were either in the top 20 based on June 2000 dollar trading volume, or in the top 20 based on June 30, 2000 market capitalization, or in the top 20 based on June 2000 share trading volume.<sup>11</sup> Of these 31, three were already included in the previous 199-stock subsample, and 6 did not pass the data filters that were applied to both the Nasdaq and NYSE stocks. Thus, there are 221 stocks in the final Nasdaq sample.

Table 1 summarizes the procedures and filters used to generate the Nasdaq sample. The selection procedure includes several filters to ensure data availability. Appendix B compares the cumulative distributions of share prices and market capitalization, and weekly volatilities for the stocks in our sample as compared to all of the National Market stocks on Nasdaq as of December 31, 1999. Table 2 shows the result of applying the same data filters to NYSE-listed US common stocks, yielding a pool of 1141 stocks. We obtained order and execution price data for all of these stocks from the NYSE.

## B. Data Sources

From Nasdaq we received all of the OATS data for our sample of 221 stocks covering the period from June 5-June 9 of 2000. From the NYSE, we received the entire SOD file for that time period and we extracted the data for all 1141 stocks. At this time, we do not have order data from other exchanges or the Nasdaq Intermarket for these NYSE-listed issues. Both the SOD and OATS files capture a large portion of the retail orders and a smaller portion of the institutional orders.

As specified by NASD rule 6951, the OATS data contain all electronic orders<sup>12</sup> in Nasdaq stocks “other than any instruction to effect a proprietary transaction originated by a trading desk.” This exclusion only applies to proprietary orders sent from one broker-dealer to another; proprietary orders sent to an ECN are entered into the OATS database by the ECN. Although we consider orders sent to all of the Nasdaq market centers, we only examine the orders in NYSE-listed stocks that were routed to the NYSE and captured in the SOD file. The SOD file includes all orders transmitted to the NYSE

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<sup>10</sup> The 199-stock sample included six stocks from the Nasdaq 100: Apple, American Power Conversion, Comverse Technology, 3-COM, S D L Inc., and Worldcom.

<sup>11</sup> Throughout this report, we define market capitalization based on the June 9, 2000 value. Using this definition, there are four stocks that were in the top 20, but were not included in the Nasdaq sample: ADC Telecommunications, Altera, Adobe Systems, and XILINX.

<sup>12</sup> Orders received verbally and over the phone were included as part of “Phase 3”, which had not yet begun as of our June 5-9 sample period.

specialist's post via the SuperDOT system, along with execution and contra party information. Market makers in NYSE-listed stocks sometimes use the SuperDOT system to submit orders to the NYSE floor, and we are unable to separate these orders from those of other customers.

We exclude from the analysis orders for which the customer requested special handling.<sup>13</sup> We also exclude orders entered before 9:30 EST, orders entered after 4:00 EST and orders that do not execute by 4:00 EST on the day they are entered.<sup>14</sup> The orders in our OATS sample account for about 70% of reported Nasdaq trades and about 50% of reported Nasdaq share volume for the 221 stocks in our sample for June 5-9. The orders in our SOD sample account for 93% of reported NYSE trades and 47% of reported NYSE share volume for the same period.

NYSE execution prices are included in the SOD data. The OATS data include neither execution prices nor contra party information, nor do they include information regarding the disposition of SelectNet-routed orders. To ascertain execution prices and contra party information, we matched the OATS data with Nasdaq audit trail data (the ACT file). Because of formatting and other problems, this matching required a multi-step process that is described in Appendix C. Through this process, we ultimately matched 97.8% of market order executions and 92.7% of limit order executions. We also matched OATS orders that were routed to SelectNet to data from the SelectNet system, and we were able to match 74.3% of these order routings. Details of the SelectNet matching procedures are also included in Appendix C.

To check for clearly erroneous trade prices, we individually examined all trades that resulted in more than a 10% effective spread on the executed portion of an order. As a result of our review, we eliminated a total of 7 orders in NYSE stocks out of a total of nearly 7 million orders. Our review of the Nasdaq execution prices did not yield any cases that were clearly erroneous.

### C. Matching of Nasdaq stocks to NYSE stocks

We are trying to isolate the differences in execution costs associated with different levels of fragmentation, so it is important to control for the fact that Nasdaq stocks and NYSE-listed stocks tend to differ along several dimensions. We use two complementary strategies to accomplish this goal: 1) we form "matched pairs" of similar stocks from each market, and 2) we use regression techniques. In some tests the regressions are used in combinations with the matched pairs to control for the differences

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<sup>13</sup> Types of orders specifically excluded are: orders to be executed at a market opening or closing price; stop and stop limit orders; short sales and other orders that must be executed on a particular tick or bid; orders submitted on a "not held" basis, all-or-none, minimum quantity or fill or kill orders; work orders; peg orders; orders required to be broken up and executed over the course of the day; scale orders; orders that are part of a program trade or arbitrage strategy; proprietary orders; orders marked do not reduce and/or do not increase; orders having a reserve size; orders to be executed after the close; odd-lot orders; and CAP orders.

<sup>14</sup> The one exception is that the adjusted spread measure for marketable limit orders (described below) includes orders that do not execute by 4:00 EST.

that remain after the matching, and in other tests we use only the regression techniques so that we can use all of the stocks in our samples. In all of the matched pair and regression tests we control for differences in

- share price (6/9/00 closing price)
- historical weekly volatility (standard deviation of weekly returns from 12/31/97 through 6/9/00),<sup>15</sup>
- market capitalization (Based on June 9, 2000 share price. Nasdaq provided June 5, 2000 shares outstanding for all of their issues. For the NYSE-listed issues, we use shares outstanding as of 12/31/99 adjusted for splits)
- adjusted<sup>16</sup> consolidated dollar trading volume (for June 5-9).

In addition, in the regressions we consider:

- an “indicator” of whether the stock passes the NYSE’s initial listing requirements
- 2-digit SIC code
- P/E ratio (the four quarters of pre-tax earnings through the first quarter of 2000, divided by the market capitalization described above)

The matching procedure cycles through all of the Nasdaq stocks alphabetically by ticker symbol. The objectives are: 1) to create pairs of stocks that are similar to each other and, 2) to create the pairs in such a way that there is no tendency for the stocks in one market to differ systematically from those in the other market. Of course if the first objective could be perfectly achieved, the second would follow automatically. Unfortunately, no two stocks are identical in all characteristics. Our matching algorithm calculates the total percentage difference between the factors for the Nasdaq stock under consideration and the factors for a candidate NYSE stock as follows ( $|x|$  denotes the absolute value of  $x$ , so for example,  $|0.1|=0.1$  and  $|-0.15|=0.15$ ):

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<sup>15</sup> This period contains 123 weeks. We also use the standard deviation over the 51 weeks from June 1999 through June 2000 as an alternative control variable in our regressions in Section IV.

<sup>16</sup> We examined 82 US common stocks that moved from the Nasdaq to the NYSE between July 1998 and August 2000. For each event, we first adjusted for stock splits and then computed average volume for two 3-month (63 trading day) windows before and after the move, excluding the 15 trading days centered on the move. To adjust for changes in the overall level of volume over the event, we divided both the pre- and post-move share volumes by the average composite volume for all NYSE-listed securities during the respective periods. We then calculated the ratio of the post-move (NYSE composite) statistic to the pre-move (Nasdaq) statistic. The average of this ratio across the stocks in our sample was 0.70. Accordingly, we use this factor (70%) to adjust the dollar volumes for our Nasdaq issues, in order to make them comparable to the (unadjusted) consolidated volumes for our NYSE-listed issues.

Total percentage difference =

$$\left[ \left| \frac{\text{Nasdaq market capitalization}}{\text{NYSE market capitalization}} - 1.0 \right| + \left| \frac{\text{Nasdaq share price}}{\text{NYSE share price}} - 1.0 \right| + \left| \frac{\text{Nasdaq adjusted volume}}{\text{NYSE adjusted volume}} - 1.0 \right| + \left| \frac{\text{Nasdaq volatility}}{\text{NYSE volatility}} - 0.95 \right| \right] \times 100\%$$

For each Nasdaq stocks, the best-matched NYSE stock is the one that minimizes the above total percentage difference.

As illustrated in Appendix B, the Nasdaq stocks as a whole and in our sample have considerably higher volatilities than those in the NYSE. Simply choosing the NYSE stock with the closest volatility produces matched pairs where the NYSE stocks have lower average volatility. To compensate for this tendency, we use the factor .95 for volatility, as opposed to 1.0 (no adjustment) for the other measures. This factor of .95 is chosen by so that we obtain a reasonably large subsample of closest matched pairs that does not have any significant average difference between the Nasdaq and NYSE volatility. While the specific adjustment is based on trial and error, the important thing is that this search proceeds without consideration of the end results; the execution cost measures are only calculated after the matching algorithm is completed. Once the best NYSE stock is found and matched to the Nasdaq stock, the NYSE stock is removed from the set of potential matches and the procedure begins again for the next Nasdaq stock.

Panel A Table 3 shows statistics for the full sample of 221 matched pairs. In spite of the attempt to provide close matches as described above, these statistics show substantial differences between the Nasdaq and the NYSE firms. Panel B shows the statistics for the subset of 58 matched pairs where the total matching criterion described above is less than 70% (on average less than 17.5% difference for each criterion). In this smaller set, the average pair-wise differences in prices, volatilities, and market capitalizations are reasonably close to zero. The adjusted volumes for the Nasdaq stocks are somewhat higher.<sup>17</sup> The execution cost results for both the subset of 58 pairs of stocks and the full set of 221 pairs of stocks are examined in Section IV.

The stocks in the subset of close matches concentrate in the relatively larger and more liquid stocks in our sample. Appendix B provides graphical comparisons of price, market capitalization and volatility for Nasdaq and NYSE firms and compares these measures for the various subsamples discussed above.

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<sup>17</sup> As shown in Table 5, this difference in average trading volume is confined to the pairs in the very large category.

D. Definitions of the Very Large, Large, Middle and Small Categories

In examining the execution cost statistics for the 58 and 221 pairs of stocks in Section IV, we analyze the differences separately for four categories based on the Nasdaq stock in the pair. The first category, which we refer to as “very large,” contains the pairs for which the Nasdaq stock was specifically identified by Nasdaq management for inclusion in the Report. The remaining other stocks from our original random sample are placed into three categories based on market capitalization: 1) over \$1 billion, 2) from \$200 million to \$1 billion and 3) below \$200 million. For the remainder of the Report, we refer to these three categories as “Large,” “Middle,” and “Small.” The table below shows the breakdown of the 221 pairs and the 58 closest matched pairs.<sup>18</sup> The number of cases where the Nasdaq stock in the pair passes NYSE listing requirements during our sample period is shown in parenthesis.<sup>19</sup>

	Size Category			
	Very Large	Large	Middle	Small
221 pairs				
-Pairs in category	25	33	72	91
-Nasdaq stock passes NYSE listing requirements	(25)	(22)	(29)	(11)
58 closest matched pairs				
-Pairs in category	5	14	26	13
-Nasdaq stock passes NYSE listing requirements	(5)	(12)	(17)	(4)

Tables 4 and 5 show how the market capitalization, price, adjusted volume, and volatility statistics vary across each of the three categories. The pairs of stocks are listed in Appendix F.

E. Definitions of Statistics

We examine the same measures and size categories contained in the execution quality disclosure rule. For the comparison of the Nasdaq and NYSE markets, we also calculate order-weighted average quoted spreads and an adjusted spread measure for marketable limit orders. The adjusted spread is similar to those used by Harris and Hasbrouck<sup>20</sup> and Handa and Schwartz<sup>21</sup>. The advantage of the measure is that it

<sup>18</sup> Appendix D shows counts of executed orders for both the NYSE and Nasdaq stocks in our 221 pairs.

<sup>19</sup> Appendix E summarizes the NYSE listing requirements. Note that there are much lower standards to avoid delisting. Accordingly, some of our 1141 NYSE-listed stocks did not meet these NYSE listing requirements as of June 5.

<sup>20</sup> Harris, L. and J. Hasbrouck, 1996, "Market vs. Limit Orders: The SuperDOT Evidence on Order Submission Strategy," *Journal of Financial and Quantitative Analysis*, 31, 213-232.

<sup>21</sup> Handa, P. and R. Schwartz, 1996, "Limit Order Trading," *Journal of Finance*, 51, 1835-1862.

captures the adverse selection costs associated with the instances where the limit order trader “misses” the market. For executed orders, this adjusted spread measure is the same as the effective spread measure for market orders in that it compares the spread midpoint at the time the order was submitted to the execution price. For unexecuted marketable limit orders (or the unexecuted portion of an order), the adjusted spread measure imputes an execution price. For a buy order, this imputed price is equal to the NBBO ask quote at the time of cancellation or expiration of the order less the average price improvement for market orders for that stock of that size.<sup>22</sup> The calculation for sell orders is analogous. As with market order effective spreads, the values reported for the adjusted spread measure are double the calculated amount, which makes them comparable to the quoted spread. Because of this doubling, the reported values should be interpreted as the estimated cost for a round-trip transaction.

Because the adjusted spread measure includes an imputed execution price based on a hypothetical market order, it is strictly appropriate only for traders who are fully committed to execution. Accordingly, we compare the measure across the two markets only for marketable limit orders.<sup>23</sup> Although traders sometimes use other types of limit orders and then follow up with market orders, we do not report the adjusted spread measure for the other types of limit orders because the limit order strategies across the two markets are so different. For example, in the Nasdaq market it is common for traders to place multiple orders in different market centers, each representing their entire desired trade. When one of these executes the others are quickly cancelled. This strategy is not as prevalent in the listed market.<sup>24</sup> When this strategy is followed successfully and the trader cancels the other limit orders, the adjusted spread measure would impute market order effective spread costs for all of these cancelled orders.

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<sup>22</sup> We use the number of unexecuted shares to determine the size category and then use the average price improvement for market orders in that stock and size category. There are a total of 147 marketable limit orders in a total of 44 Nasdaq stocks where the cancelled/expired portion of the order is in a size category for which there are no market orders for that stock. In these cases, we estimate price improvement to be -3.99 cents, -9.86 cents and -11.80 cents for orders in the 500-1999 share, 2000-4999 share and 5000+ share categories. There are a total of 146 marketable limit orders in a total of 77 NYSE stocks where the cancelled/expired portion of the order is in a size category for which there are no market orders for that stock. In these cases, we estimate price improvement to be +2.59 cents, -0.75 cents and -4.86 cents for orders in the 500-1999 share, 2000-4999 share and 5000+ share categories. These are the averages for market orders of these sizes across all of the NYSE stocks in our sample.

<sup>23</sup> On the Nasdaq, some traders submit and cancel marketable limit orders extremely rapidly, sometimes in less than one second. Usually, these orders are part of a two-part strategy, where the marketable limit order is “fishing” for a hidden order on an ECN. If the hidden order is there, then the incoming marketable limit will execute, often with price improvement. If the order does not immediately execute, it is cancelled and generally followed up with a market order. The adjusted spread measure correctly captures the full cost of this strategy, whereas any measure based solely on executed orders would underestimate the cost.

<sup>24</sup> There may be two reasons why this strategy is not as prevalent in the listed market. First, in the listed market it is more difficult to cancel orders quickly, so the trader runs the risk of trading more than the desired number of shares. The second reason may be that execution of an order sent to a single venue is more likely, either because of higher consolidation of order flow (if the order is sent to the NYSE) or to “print protection” (if the order is sent to a regional exchange).

#### IV. Comparison of Nasdaq Execution Costs to NYSE Execution Costs

##### A. Statistical Methods

In this section, we compare the NYSE and Nasdaq based on a variety of measures and order size categories. Each calculation is done separately for the four categories described above: very large, large, middle and small. For each of these categories, we estimate the difference between the Nasdaq and NYSE stocks using twelve different statistical tests, two that use the matched pairs exclusively, three that add regression controls to the matched pairs, and seven that use regressions and allow all of the stocks to be included.<sup>25</sup>

The first test uses the sample of 58 closest matched pairs of Nasdaq and NYSE stocks described in section III.C. For each stock in the pair, we use the share-weighted average of the measure across all of the orders of that type and size category.<sup>26</sup> We calculate the difference across each pair and report the average of these differences. Statistical significance is judged by applying the standard t-test to these pair-wise differences. The second test is similar to the first, except we use all of the 221 pairs of stocks.

The third, fourth, and fifth tests continue with the 221 pairs of stocks but introduce regression techniques to control for differences in share price, weekly volatility, market capitalization, dollar trading volume, and whether the Nasdaq stock and/or the NYSE stock in the pair passes the NYSE's initial listing requirements. To allow rigorous descriptions of these regressions, we introduce the following notation: (in all cases differences are the Nasdaq value minus the NYSE value)

- $j$  = index to pairs of stocks
- $X_j$  = Difference in the average execution cost statistic for pair  $j$
- $M_j$  = Difference in the natural logarithms of the market capitalization for pair  $j$
- $P_j$  = Difference in the reciprocals of share price for pair  $j$
- $D_j$  = Difference in the natural logarithms of weekly dollar trading volume for pair  $j$
- $VL_j$  = Difference in the weekly volatilities for pair  $j$ , estimated using 123 weeks from December 1997 through June of 2000 (used in tests 3 and 5)
- $VS_j$  = Difference in the weekly volatilities for pair  $j$ , estimated using 51 weeks from June 1999 through June of 2000 (used in test 4)
- $QNL_j$  = Indicator variable equal to one if the Nasdaq stock in pair  $j$  does not pass the NYSE initial listing requirements and the NYSE stock does pass, equal to

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<sup>25</sup> We exclude a pair from tests 1-5 if there are fewer than five orders (over the week) of the size and type under consideration, for either of the stocks in the pair. Similarly, we exclude a stock from tests 6-11 if there are fewer than 5 orders (over the week) of the size and type under consideration.

<sup>26</sup> Except in the case of quoted spread, where we measure the quoted spread in effect at the time of arrival of each market order and then average across the market orders in all size categories for the stock.

zero if either both pass or both don't pass, and equal to -1 if the Nasdaq stock passes and the NYSE stock does not pass.

The regressions for the third, fourth and fifth tests are as follows:

$$X_j = \mathbf{b}_Q + \mathbf{b}_M M_j + \mathbf{b}_P P_j + \mathbf{b}_D D_j + \mathbf{b}_V VL_j + \varepsilon_j \quad (\text{test 3})$$

$$X_j = \mathbf{b}_Q + \mathbf{b}_M M_j + \mathbf{b}_P P_j + \mathbf{b}_D D_j + \mathbf{b}_V VS_j + \varepsilon_j \quad (\text{test 4})$$

$$X_j = \mathbf{b}_Q + \mathbf{b}_M M_j + \mathbf{b}_P P_j + \mathbf{b}_D D_j + \mathbf{b}_V VL_j + \mathbf{b}_L QNL_j + \varepsilon_j \quad (\text{test 5})$$

The estimated intercept  $\mathbf{b}_Q$  is the estimated difference between the NYSE and Nasdaq statistics after controlling for differences in share price, weekly volatility, market capitalization, and dollar trading volume (and in test 5 conditioning on the Nasdaq stock passing the NYSE listing requirements). The statistical significance of this estimate is calculated using White's non-parametric correction to allow for the heteroscedasticity in the  $\varepsilon_j$ 's.

The remaining seven tests depart from the pairwise comparisons to allow us to use all of the information in the 1141 NYSE stocks. We still perform these tests separately for each of the four size categories of Nasdaq stocks. For a NYSE stock to be included in a particular test for a particular category, its price, market capitalization, volume and volatility each must lie between the minimum and maximum across the Nasdaq stocks in the category.

Tests six through ten continue to use the averages for the stock across the order size and order type under consideration. To describe these tests, we use the following notation:

- $j$  = index to individual stocks
- $X_j$  = Average execution cost statistic for stock  $j$
- $IQ_j$  = an indicator variable that takes the value one if stock  $j$  is a Nasdaq stock and zero otherwise
- $M_j$  = Natural logarithm of the market capitalization for stock  $j$
- $P_j$  = Reciprocal of share price for stock  $j$
- $D_j$  = Natural logarithm of weekly dollar trading volume for stock  $j$
- $VL_j$  = Weekly volatility for stock  $j$ , estimated using 123 weeks from December 1997 through June of 2000
- $VS_j$  = Weekly volatility for stock  $j$ , estimated using 51 weeks from June 1999 through June of 2000
- $PE_j^+$  = Natural logarithm of the price-earnings ratio<sup>27</sup> if this ratio is positive, zero otherwise

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<sup>27</sup> The price earnings ratio is calculated by dividing the June 9 market capitalization by the sum of pre-tax income over the period from the second quarter of 1999 through the first quarter of 2000.

- $PE_j^-$  = Natural logarithm of the absolute value of the price-earnings ratio if this ratio is negative, zero otherwise  
 $ISIC_{j,k}$  = Indicator variable equal to one if the two-digit primary SIC code for stock  $j$  is equal to  $k$ , zero otherwise  
 $INL_j$  = Indicator variable equal to one if stock  $j$  does not pass the NYSE initial listing requirements, and equal to zero if it passes.  
 $INPE_j$  = Indicator variable equal to one if the price-earnings ratio is negative, zero otherwise

The regressions for tests 6-10 are as follows:

$$X_j = \alpha + b_Q IQ_j + b_M M_j + b_P P_j + b_D D_j + b_V VL_j + \varepsilon_j \quad (\text{test 6})$$

$$X_j = \alpha + b_Q IQ_j + b_M M_j + b_P P_j + b_D D_j + b_V VS_j + \varepsilon_j \quad (\text{test 7})$$

$$X_j = b_Q IQ_j + b_M M_j + b_P P_j + b_D D_j + b_V VL_j + \sum_{k=0}^{99} b_{S,k} ISIC_{j,k} + \varepsilon_j \quad (\text{test 8})^{28}$$

$$X_j = \alpha + b_Q IQ_j + b_M M_j + b_P P_j + b_D D_j + b_V VL_j + b_L INL_j + \varepsilon_j \quad (\text{test 9})$$

$$X_j = \alpha + b_Q IQ_j + b_M M_j + b_P P_j + b_D D_j + b_V VL_j + b_+ PE_j^+ + b_- PE_j^- + b_N INPE_j + \varepsilon_j \quad (\text{test 10})$$

The estimated coefficient  $b_Q$  is the estimated difference between the Nasdaq and NYSE statistics after controlling for differences in share price, weekly volatility, market capitalization, and dollar trading volume (plus primary SIC code in the case of test 8, plus NYSE listing criteria in test 9, and plus price-earnings ration in test 10). The statistical significance of this estimate is again calculated using White's non-parametric correction to allow for the heteroscedasticity in the  $\varepsilon_j$ 's.

The eleventh test allows the slope coefficients  $b_M$ ,  $b_P$ ,  $b_D$ , and  $b_V$  for the Nasdaq stocks to differ from those of the NYSE stocks. In this test we redefine  $M_j$ ,  $P_j$ ,  $D_j$ , and  $VL_j$  to be equal to the value of the statistic for stock  $j$  *less the mean of this statistic across all of the Nasdaq stocks in the category*.<sup>29</sup> We continue with the same definition of the indicator variable  $IQ_j$ . With these new definitions the regression for test 11 is as follows:

$$X_j = \alpha + b_Q IQ_j + b_M M_j + b_P P_j + b_D D_j + b_V VL_j + b_{M,Q} IQ_j M_j + b_{P,Q} IQ_j P_j + b_{D,Q} IQ_j D_j + b_{V,Q} IQ_j VL_j + \varepsilon_j \quad (\text{test 11})$$

<sup>28</sup> There is no separate constant term in the regression for test 8 because the SIC dummy variables sum to a column of ones.

<sup>29</sup> The subtracting of a constant from each of the independent variables in the regression does not change the estimated slope coefficients, or the fit of the regression. Rather, it changes the values and interpretation of the intercept terms. In this case, the subtraction is necessary to allow the appropriate interpretation of  $b_Q$ .

In this case, the estimated coefficient  $b_Q$  is the estimated difference between the Nasdaq and NYSE statistics for a firm *whose share price, weekly volatility, market capitalization, and dollar trading volume are all equal to the means of values for the Nasdaq stocks in the category.*

The twelfth and final test allows us to use all of the information in the individual orders for each stock to improve the efficiency of our estimates. The notation is similar to that for test six above, except now there is a t subscript on the execution cost statistic as well as the error term. This notation is given in full below:

- j = index to individual stocks
- t = index to orders for each stock
- $X_{j,t}$  = Execution cost statistic for order t of stock j
- $IQ_j$  = an indicator variable that takes the value one if stock j is a Nasdaq stock and zero otherwise
- $M_j$  = Natural logarithm of the market capitalization for stock j
- $P_j$  = Reciprocal of share price for stock j
- $D_j$  = Natural logarithm of weekly dollar trading volume for stock j
- $V_j$  = Weekly volatility for stock j

The regression for test 12 takes the form:

$$X_{j,t} = \alpha + b_Q IQ_j + b_M M_j + b_P P_j + b_D D_j + b_V V_j + u_{j,t} \quad (\text{test 12})$$

where the error term allows for a single security wide error due to potentially omitted factors as follows:

$$u_{j,t} = \mu_j + \varepsilon_{j,t}$$

where  $\mu_j$  and  $\varepsilon_{j,t}$  are normally distributed with zero means and unknown standard deviations of  $\sigma_\mu$  and  $\sigma_\varepsilon$ , respectively.

The regressions described above are estimated using feasible generalized least squares. The estimated coefficient  $b_Q$  is the estimated difference between the Nasdaq and NYSE statistics after controlling for differences in share price, weekly volatility, market capitalization, and dollar trading volume. The statistical significance of this estimate is again calculated using White's non-parametric correction to allow for the heteroscedasticity in both the  $\mu$ 's and the  $\varepsilon$ 's.<sup>30</sup>

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<sup>30</sup> The regressions were estimated using SAS's PROC MIXED with method=REML and the EMPIRICAL option to produce a heteroscedasticity-consistent p-value.

## B. Results For Execution Costs

The detailed results of our tests are shown in Tables 6-30. For the most part, the results from test 1 are quite similar to those from tests 2-12. Accordingly, in this section we focus on the results for the first test, which uses the closest matches.

We begin the investigation of execution cost by focusing on effective spreads for market orders. The effective spread measures the execution cost paid by investors by comparing the execution price to the midpoint of the NBBO quoted spread at the time that the order arrived at the market center for execution. These cost differences are doubled in order to make the effective spread statistics comparable to quoted spreads. For example, if a buy order arrives when the spread midpoint is \$20 per share and the buyer pays \$20.125 per share, the effective spread is  $(20.125 - 20) \times 2$ , which equals \$.25 per share.

The effective spread results for the three different market order sizes are shown in Tables 6, 7, and 8. The results of the first matched-pairs test from each of these tables are reproduced below. For market orders of 100-499 shares in the very large category, the table shows that Nasdaq effective spreads are lower than NYSE effective spreads by 1.2 cents per share, however, this estimate is statistically insignificant and the results are mixed across the range of the tests. For 100-499 share market orders in the large, middle and small categories, the first matched-pair test shows that the average Nasdaq effective spreads are from 5.7 to 11 cents per share wider than those for the matched NYSE stocks. These differences are statistically significant and consistent across the range of tests.

	Effective Spreads by Issuer Size Category			
	Very Large	Large	Middle	Small
<u>100-499 Share Market Orders</u>				
Average Across Nasdaq Stocks	0.071	0.150	0.206	0.164
Average Across NYSE Stocks	0.083	0.093	0.097	0.088
Difference	-0.012	0.057 **	0.110 ***	0.076 *
<u>500-1999 Share Market Orders</u>				
Average Across Nasdaq Stocks	0.086	0.168	0.276	0.131
Average Across NYSE Stocks	0.117	0.142	0.139	0.097
Difference	-0.031	0.026	0.136 **	0.034
<u>2000-4999 Share Market Orders</u>				
Average Across Nasdaq Stocks	0.142	0.244	0.299	0.176
Average Across NYSE Stocks	0.184	0.190	0.144	0.117
Difference	-0.041	0.055	0.154 **	0.059

\*, \*\*, and \*\*\* denote statistical significance at the 10%, 5%, and 1% levels, respectively

The generally higher effective spreads for Nasdaq market orders, for all but the very large stocks, arguably might be explained by more difficult order flow. In other words, the dealers or other traders who are supplying liquidity on Nasdaq might be forced to charge wider effective spreads to protect themselves against a high proportion of informed trades included in the market orders. To test this possibility, we also examine realized spreads. The realized spread is similar to the effective spread, except that it uses

the midpoint of the NBBO quoted spread five minutes after the order was executed. As its name implies, the realized spread is a very short-term proxy for the potential profit realized by the dealer or other trader taking the other side of the order.

The realized spread results for the three different market order sizes are shown in Tables 9, 10, and 11. The results of the first test from each of these tables are reproduced below. These results suggest that the higher effective spreads on Nasdaq for all but the very large category are not a result of more difficult order flow.

	Realized Spreads by Issuer Size Category			
	Very Large	Large	Middle	Small
<u>100-499 Share Market Orders</u>				
Average Across Nasdaq Stocks	0.025	0.081	0.177	0.155
Average Across NYSE Stocks	0.025	0.013	0.028	0.048
Difference	0.000	0.068 **	0.149 ***	0.107 ***
<u>500-1999 Share Market Orders</u>				
Average Across Nasdaq Stocks	0.046	0.058	0.095	0.087
Average Across NYSE Stocks	0.015	0.009	0.011	0.037
Difference	0.030 *	0.050 ***	0.084 ***	0.051 *
<u>2000-4999 Share Market Orders</u>				
Average Across Nasdaq Stocks	0.055	0.112	0.208	0.128
Average Across NYSE Stocks	0.032	0.032	-0.050	0.033
Difference	0.024	0.080	0.258 *	0.095 *

\*, \*\*, and \*\*\* denote statistical significance at the 10%, 5%, and 1% levels, respectively

To provide a comparison with the effective spreads paid by investors, the Report also examines quoted spreads. For each stock, the statistic is calculated by measuring the NBBO quoted spread at the time of arrival of each market order, and then averaging across all market orders. In the very large category, the Report finds that quoted spreads on Nasdaq are on average 5.4 cents per share narrower than quoted spreads for the matched NYSE stocks. Comparing quoted spreads to effective spreads suggests that in Nasdaq stocks many orders are executed at the quotes, whereas many orders sent to the NYSE are executed at better prices inside the quotes. The NYSE rules require that the orders be given the opportunity to interact with other orders, which can result in price improvement. In the large and small categories, quoted spreads are nearly equal across the two markets, whereas the average Nasdaq quoted spreads are somewhat wider in the middle category. As is the case for the very large stocks, the Nasdaq quoted spreads for the other three categories are roughly equal to the effective spreads, whereas the effective spreads for small market orders sent to the NYSE reflect substantial price improvement.

	NBBO Quoted Spreads by Issuer Size Category			
	Very Large	Large	Middle	Small
Average Across Nasdaq Stocks	0.079	0.149	0.211	0.154
Average Across NYSE Stocks	0.133	0.148	0.157	0.138
Difference	-0.054 **	0.001	0.053 **	0.016

\* and \*\* denote statistical significance at the 10% and 5% levels, respectively

Although there tends to be little price improvement for market orders sent to Nasdaq dealer market centers, there can be price improvement for marketable limit orders sent to ECN's if there is an undisplayed order inside the ECN. Accordingly, many traders in Nasdaq stocks use the strategy of first submitting a marketable limit order and then following up with a market order if the marketable limit order fails to execute. Our adjusted spread measure is designed with this strategy in mind. It is important to note however, that not all unexecuted marketable limit orders are followed by a market order. In these cases, the failure to execute is still costly to the trader, but it is unclear whether the implicit cost estimate included in the adjusted spread measure is appropriate.<sup>31</sup>

The adjusted spread results for marketable limit orders in the three different size categories are shown in tables 13, 14 and 15. The results of the first test from each of these tables are reproduced below.

	Adjusted Spreads by Issuer Size Category			
	Very Large	Large	Middle	Small
<u>100-499 Share Marketable Limit Orders</u>				
Average Across Nasdaq Stocks	0.080	0.168	0.193	0.183
Average Across NYSE Stocks	0.087	0.102	0.114	0.093
Difference	-0.007	0.067 **	0.079 ***	0.090
<u>500-1999 Share Marketable Limit Orders</u>				
Average Across Nasdaq Stocks	0.092	0.175	0.225	0.161
Average Across NYSE Stocks	0.124	0.167	0.150	0.123
Difference	-0.031	0.008	0.075 **	0.038
<u>2000-4999 Share Marketable Limit Orders</u>				
Average Across Nasdaq Stocks	0.123	0.229	0.273	0.414
Average Across NYSE Stocks	0.170	0.188	0.196	0.188
Difference	-0.046	0.041	0.076	0.226

\*, \*\*, and \*\*\* denote statistical significance at the 10%, 5%, and 1% levels, respectively

### C. Time to Execution and Fill Rates

The Report finds that market order executions are generally faster on Nasdaq than on the NYSE for 100-499 share orders. The difference disappears for the 500-1999 share

<sup>31</sup> As discussed in Section III.E., the problem of assigning a cost for unexecuted orders becomes even more acute for non-marketable limit orders, because the strategies used differ substantially across the two market structures. Accordingly, we have not included the adjusted and realized spread results for the non-marketable limit orders in this report.

market orders. Our results indicate that the NYSE executions tend to be somewhat faster than the Nasdaq executions for 2000-4999 share market orders, but Nasdaq believes that many large “not held” orders are not properly identified in their system. This miscoding may reduce the accuracy of the comparison between the two markets for the largest category of orders. The following Table shows the results for the 58 closest matched pairs. As shown on Tables 19-21, the other tests yield similar results.<sup>32</sup>

	Execution times in Seconds by Issuer Size Category			
	Very Large	Large	Middle	Small
<u>100-499 Share Market Orders</u>				
Average Across Nasdaq Stocks	3.4	6.0	7.8	4.5
Average Across NYSE Stocks	17.1	15.8	26.5	15.8
Difference	-13.7 ***	-9.8 ***	-18.7 ***	-11.3 ***
<u>500-1999 Share Market Orders</u>				
Average Across Nasdaq Stocks	17.3	24.0	25.0	16.8
Average Across NYSE Stocks	20.6	17.4	27.9	20.6
Difference	-3.3	6.6 **	-2.9	-3.8
<u>2000-4999 Share Market Orders</u>				
Average Across Nasdaq Stocks	53.2	73.3	91.4	72.9
Average Across NYSE Stocks	24.3	28.1	50.2	25.6
Difference	29.0 *	45.2 ***	41.2	47.3 **

\*, \*\*, and \*\*\* denote statistical significance at the 10%, 5%, and 1% levels, respectively

Average fill rates for marketable, inside the quote and at the quote limit orders are reported in Tables 22-30.

## V. Variance Ratio Tests

### A. Motivation

In this section, we use consolidated trade return data to compare the ratios of daily to weekly (and daily to monthly) return variances for NYSE and Nasdaq stocks.<sup>33</sup> In efficient markets, the return variance measured over any time interval should be proportional to the length of the interval (i.e., the longer the time interval, the greater the expected return variance). Market inefficiencies, such as effective spreads between bid and offer prices, temporary overreactions to order flow due to lack of “resiliency” in a market, or short-term price manipulation, will all tend to cause return reversals. The tendency of relatively high (low) returns to be followed by relatively low (high) returns is called negative serial autocorrelation. As discussed in Roll<sup>34</sup>, Hasbrouck and Schwartz

<sup>32</sup> There was one 500-1999 share market order in a small Nasdaq stock that took more than two hours to execute. This order was excluded from the analysis of execution times. No other Nasdaq market order took more than one hour to execute.

<sup>33</sup> “Return variance” is the sample variance of returns, which include dividends and other distributions as well as price appreciation.

<sup>34</sup> Roll, R., 1984, “A simple Implicit Measure of the Effective Bid-Ask Spread in an Efficient Market,” *Journal of Finance*, 1127-1139.

<sup>35</sup>, and Campbell, Lo and MacKinlay <sup>36</sup>, in the presence of negative serial autocorrelation of returns, the observed variances over shorter time intervals (such as days) can be greater than one would predict given the observed variances over longer time intervals (such as weeks or months). In other words, the greater the extent of return reversals in a particular market, the more likely that short-term return variances will be greater in relation to long-term return variances.

By comparing the ratios of daily to weekly (and daily to monthly) return variances for NYSE and Nasdaq stocks, we analyze whether the two different market structures are associated with differing levels of return reversals. One of the advantages of using the ratios, is that there is a built-in control for the underlying uncertainty as to the “true” value of the stock. For example, the high variance of returns on technology stocks is to be expected given the high uncertainty as to their future cash flows. The point is that this uncertainty will manifest itself in *both* the daily and weekly return variances. When we divide the weekly return by the daily return,<sup>37</sup> the natural uncertainty associated with the stock “washes out” and we are left with a measure associated with transaction costs or some other form of inefficiency.

In light of our earlier findings that Nasdaq effective spreads between bid and offer prices tend to be greater in several categories of stocks, we would expect that variance ratios would be greater in Nasdaq stocks than in NYSE stocks for these categories. In section V.E. below, therefore, we also examine variance ratios after controlling for differences in effective spreads between the two market structures. If differences in variance ratios persist between the two market structures, we would predict that they are associated with types of inefficiencies other than bid-offer spreads.

## B. Data and Return Calculation

From the Center for Research in Securities Prices (CRSP), we collect daily percentage stock returns (price appreciation plus dividends and distributions) from January 1997 through December 1999 for our matching 221 Nasdaq and NYSE sample stocks and for the S&P 500 index.

$R_{i,d}$  = Percentage return for stock *i* over day *d*  
 $M_d$  = Percentage return for the S&P 500 index

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<sup>35</sup> Hasbrouck and Schwartz, 1988, "Liquidity and Execution Costs in Equity Markets," Journal of Portfolio Management, 10-16.

<sup>36</sup> Hasbrouck and Schwartz, 1988, "Liquidity and Execution Costs in Equity Markets," Journal of Portfolio Management, 10-16.

<sup>37</sup> While it is perfectly acceptable to take the simple ratio of the weekly (or four week) variance to the daily variance, we follow the standard approach of re-scaling this ratio by the relative lengths of the time periods being compared. This scaling makes the “target” value of the ratio equal to one, assuming no transaction costs or other inefficiencies, and it makes it easier to compare the values of the weekly/daily variance ratio to the values of the four-week-to-daily variance ratio and the values of the four-week-to-one-week variance ratio.

From the raw returns above, we calculate one-day, one-week and four-week continuously compounded excess returns as follows:<sup>38</sup>

- $dr_{i,d}$  = continuously-compounded excess return for stock  $i$  over day  $d$ , calculated as  $dr_{i,d} = \ln(1+R_{i,d} - M_d)$ , where  $\ln$  represents the natural logarithm function.
- $wr_{i,w}$  = continuously-compounded excess return for stock  $i$  over week  $w$ , calculated as  $wr_{i,w} = dr_{i,d1} + dr_{i,d2} + dr_{i,d3} + dr_{i,d4} + dr_{i,d5}$ , where  $d1$  through  $d5$  are the trading days from Wednesday to Tuesday that comprise week  $w$ .
- $mr_{i,m}$  = continuously-compounded excess return for stock  $i$  over the four-week period  $m$  (approximately a “month”), calculated as  $mr_{i,m} = wr_{i,w1} + wr_{i,w2} + wr_{i,w3} + wr_{i,w4}$ , where  $w1$  through  $w4$  are the weeks that comprise month  $m$ .<sup>39</sup>

We use the above notation without the second subscript to refer to the full sample for a particular stock. For example,  $dr_i$  denotes the full sequence of continuously compounded daily returns for stock  $i$ . Our sample contains 757 daily return observations, 156 weekly return observations and 39 monthly return observations. Because of trading holidays and days with missing returns, on average there are fewer than 5 days in each trading week and fewer than 20 days in each four-week period. In the following discussion, we describe the calculations of ratios that compare weekly return variances to daily return variances and the ratios that compare four-week return variances to daily return variances. We also report results for ratios that compare four-week return variances to one-week return variances, the calculations of which are analogous to those described below.

In order to calculate the ratios, we need the following quantities for each stock:

- $nwd_i$  = number of daily observations divided by number of weekly observations for stock  $i$  (average days per week)
- $nmd_i$  = number of daily observations divided by number of four-week observations for stock  $i$  (average days per four-week period)

### C. Methodology for Variance Ratios

As discussed by Campbell, Lo and MacKinlay (1997), the theory underlying the variance ratios rests on the observation that in an efficient market the return from one day should not be correlated with the return the next day. By efficient market we mean one with no transaction costs and rational traders. If there were correlation but no transaction costs, then this would imply a profitable trading strategy based on the current day’s

<sup>38</sup> We use excess returns to reduce the cross-sectional correlations in our sample, thereby making the statistics approximately independent.

<sup>39</sup> This statistic can also be defined as  $dr_{i,d1} + dr_{i,d2} + \dots + dr_{i,d20}$ , where  $d1$  through  $d20$  are the 20 trading days that comprise a month.

return. The fact that this strategy persists would mean that traders were not trying to exploit it, thus contradicting their presumed rationality.<sup>40</sup>

Following Campbell, Lo and MacKinlay, under the hypothetical case of market efficiency, we model the evolution of the excess return on each stock through time as a *geometric Brownian motion*.<sup>41</sup> Under this model, the following variance ratio statistics to be calculated from our sample have an expected value of one:

$$\text{week-to-day:} \quad Q_{w,d,i} = \left( \frac{1}{nwd_i} \right) \frac{\text{Var}[wr_i]}{\text{Var}[dr_i]}$$

$$\text{four-week-to-day:} \quad Q_{m,d,i} = \left( \frac{1}{nmd_i} \right) \frac{\text{Var}[mr_i]}{\text{Var}[dr_i]}$$

Of course, we know that actual markets do have transaction costs so we don't really expect the above statistics to have averages equal to one for the stocks in our sample. Rather, these particular statistics provide a convenient way to summarize the impact of these transaction costs. The more the statistic falls below one, the greater are the inefficiencies in the market *relative to* the volatility that stems from uncertainty as to the stock's underlying value. Given that the previous section gives us independent estimates of the effective spreads, we can also investigate the impact of the inefficiencies that go beyond those associated with the spreads. We return to this issue in subsection E. below.

#### D. Results

In Table 31, we compare the one-week-to-day variance ratio statistics for the pairs of Nasdaq and NYSE stocks in the very large, large, middle, and small categories. The comparisons use the same tests one through eleven defined in the previous section. The table shows that the average variance ratios for the Nasdaq and NYSE stocks in the very large category are statistically indistinguishable from each other. For the other three categories, the table shows that the ratios drop well below one and that the averages of the Nasdaq ratios are lower than those for the NYSE. Table 32 shows the results for the ratios comparing four-week periods to days, and Table 33 shows the results for the ratios comparing four-week periods to one-week periods.

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<sup>40</sup> This discussion is somewhat simplified for the purposes of clearer exposition. In more complex models than the one we employ, certain types of predictability can still be consistent with market efficiency.

<sup>41</sup> This model of the return process implies: 1) both the expected value and the variance of the continuously-compounded return on the stock are proportional to the length of the time interval, 2) these returns are uncorrelated over any two non-overlapping intervals (consistent with market efficiency), and 3) that the continuously compounded returns are normally distributed random variables. This model of returns was popularized by Black and Scholes in their seminal paper on options pricing theory, and is common in financial research today. Black, F., and M. Scholes, 1973, "The Pricing of Options and Corporate Liabilities," *Journal of Political Economy*, 81, 637-654.

### E. Inefficiencies Beyond Effective Spreads

The results in Table 31 are consistent with the larger effective spreads found for Nasdaq stocks in Section IV. We now turn to the question of whether those effective spreads fully explain the magnitude of these variance ratios. To answer this question, we construct a benchmark statistic that gives us the expected value of the variance ratio under the assumption that the only inefficiency is the transaction cost due to the effective spread. Following Roll (1984) we assume the effective spread is a constant proportion of the stock price and that the direction of the last trade of the day is independent from the direction of the last trade for the previous day. Define

$$s_i = \ln\left(\frac{\text{Dollar Effective Spread}_i}{\text{Stock Price}} + 1\right)$$

Where the dollar effective spread in the above expression is the order-weighted average across all market orders for stock  $i$  in our sample.

Under these assumptions, the continuously-compounded returns we observe will include a component equal to  $+s_i$  if the stock is “bouncing” from bid to ask and  $-s_i$  if the stock is “bouncing” from ask to bid. This means that the variance of the continuously-compounded return measured over each trading day increases by the amount  $s_i^2/2$ . The same is also true for each trading week. If we assume that this is the only inefficiency, then the variance of the weekly return will have two components:

$$\text{Var}[wr_i] = \text{Var}[wr_i]^* + s_i^2/2$$

where  $\text{Var}[wr_i]^*$  is the hypothetical variance attributable the uncertainty as to the stock’s underlying value. If bid-ask bounce were the only inefficiency, then the daily variance would be equal to  $(1/nwd_i)\text{Var}[wr_i]^* + s_i^2/2$ . Combining this with the previous expression and using the average of  $nwd_i$  trading days per week for our sample, we have the following benchmark for the week-to-day variance ratio assuming the effective spread is the only inefficiency:

$$\text{BQ}_{w,d,i} = \frac{\text{Var}[wr_i]}{\text{Var}[wr_i] + (nwd_i - 1) s_i^2/2}$$

The analogous calculations gives benchmark for the four-week-to-day variance ratio:

$$\text{BQ}_{m,d,i} = \frac{\text{Var}[mr_i]}{\text{Var}[mr_i] + (nmd_i - 1) s_i^2/2}$$

Using these benchmarks, we calculate adjusted variance statistics for each stock, defined as follows:

$$AQ_{w,d,i} = Q_{w,d,i} + (1 - BQ_{w,d,i}) \quad \text{and} \quad AQ_{m,d,i} = Q_{m,d,i} + (1 - BQ_{m,d,i})$$

The results of the various tests comparing these adjusted weekly-to-daily variance ratios statistics for the Nasdaq and NYSE stocks are shown in Table 34. Not surprisingly, the adjustments have little impact on the stocks in the very large category, because their effective spreads are very small, especially as a percent of share price. In the other categories, the adjustment narrows the differences between the ratios for the Nasdaq and NYSE stocks. This is also to be expected, because the Nasdaq stocks in these categories have larger effective spreads. There still appear to be some differences between the Nasdaq and NYSE stocks, beyond what can be explained by effective spreads. The results for the adjusted four-week-to-daily and four-week-to-one-week variance ratios are shown in Tables 35 and 36.

The adjustments in Tables 34, 35 and 36 are based on the effective spread measured during the week of June 5-9 2000. Accordingly, the remaining difference between the Nasdaq and NYSE ratios may indicate that the proportional spreads were relatively larger for the Nasdaq stocks during the 1997-1999 period used for the variance ratio tests. The differences are also consistent with the existence of inefficiencies that go beyond proportional spreads. The OATS data are relatively new, and do not permit separate estimates of the proportional effective spread for the earlier time period.

#### F. Additional Tests Using Variance Ratios

As an alternative test of spread-based inefficiencies and inefficiencies that go beyond the spread, we examined 82 US common stocks that moved from the Nasdaq to the NYSE between July 1998 and August 2000. For each event, we computed daily and five day continuously-compounded returns for the two 3-month (60 trading days) windows on either side of the move, excluding the 15 trading days centered on the move. We calculated two return sequences, one using closing prices and the other using the midpoints of the NBBO quotes as of 12:30 pm. We calculated the week-to-day variance ratios for the pre-and post move windows for both of these return series.

We found that the variance ratios using the returns based on closing prices rose by an average of .28 between the pre-move (Nasdaq) and post-move (NYSE) windows. This difference is somewhat larger than the differences reported in table 31 for the large, middle and small categories, and it is statistically significant at the 1% level using a two-tailed t-test of the pair-wise differences. When using the returns based on bid-ask midpoints to eliminate the effects of “bid-ask bounce” we found that the variance ratios rose by an average of .17. This number is similar in magnitude to the differences reported in table 34 for the large, middle and small categories, and it is statistically significant at the 1% level using a two-tailed t-test of the pair-wise differences.

## VI. Summary

The Report compares the executions of customer orders in securities listed on Nasdaq to the executions of customer orders in NYSE-listed securities that are routed to the NYSE. The Report uses customer order data, which has only recently come available for Nasdaq securities, which enables accurate calculation of effective and realized spreads and order execution speeds, and also allows separate analysis of different types of orders. For the most part, the Report uses measures that will soon be available directly from market centers under Securities Exchange Act Rule 11Ac1-5 -- the Commission's recently adopted Execution Quality Disclosure Rule.

The results are separately calculated for four categories of Nasdaq stocks:

- 1) A group of the very largest Nasdaq stocks in terms of trading volume and market capitalization, as specifically selected by Nasdaq
- 2) A random sample of Nasdaq stocks with market capitalization over \$1 billion
- 3) A random sample of Nasdaq stocks with market capitalization between \$200 million and \$1 billion
- 4) A random sample of Nasdaq stocks with market capitalization less than \$200 million

The Report includes a "matched pair" analysis that compares order executions in Nasdaq-listed stocks to NYSE order executions in NYSE-listed stocks, where the stocks in each pair have similar market capitalization, share price, return volatility and trading volume. This matched pair analysis is complemented and confirmed by other tests that use larger samples and use regression techniques to control for differences in these and other features. Seven of these tests rely entirely on regression techniques to make comparisons across the two samples, without any need to consider specific matched pairs.

Table 1  
Nasdaq Sample Selection

	Number Failing Screen	Percent of Previous Sample	Remaining Sample
Nasdaq common stocks in the CRSP database with non-zero price information on 12/31/99 (some were just quotes with no trades -- see below)			4341
<b>Filters Applied:</b>			
Daily returns available from 12/31/97 - 12/31/99 and classified as a Nasdaq common stock for the full period	929	21%	3412
COMPUSTAT data available (12/31/97)	154	5%	3259
Trade price available on 12/31/99	160	5%	3099
Closing price on 12/31/99 within 10% of CRSP closing price	21	1%	3078
Trade price available each day in Jan 2000	560	18%	2518
Average of at least 20 trades/day in Jan 2000	316	13%	2202
Average of at least \$20,000/day in Jan 2000	0	0%	2202
Trade price available each day in Feb-Apr 2000	201	9%	2001
No day in Feb-Apr 2000 with mean trade price < \$3	357	18%	1644
Sort by Jan 2000 trading volume and select every eighth stock (drop 5 smallest)	1444	88%	200
Trading data available for June 5-9	1	.5%	199
No multiple classes of the same stock	0	0%	199
Add back very large stocks at Nasdaq's request	(22)	11%	221

Table 2  
NYSE Sample Selection

			1904
	Number	Percent of	Remaining
<u>Filters Applied:</u>	<u>Failing Screen</u>	<u>Previous Sample</u>	<u>Sample</u>
NYSE common stocks in the CRSP database with non-zero price information on 12/31/99 (some were just quotes with no trades -- see below)			1904
Daily returns available from 12/31/97 - 12/31/99 and classified as an NYSE common stock for the full period	293	15%	1611
COMPUSTAT data available (12/31/97)	47	3%	1564
Trade price available on 12/31/99	24	1%	1540
Closing price on 12/31/99 within 10% of CRSP closing price	0	0%	1540
Trade price available each day in Jan 2000	66	4%	1474
Average of at least 20 trades/day in Jan 2000	219	15%	1255
Average of at least \$20,000/day in Jan 2000	0	0%	1255
Trade price available each day in Feb-Apr 2000	46	4%	1209
No day in Feb-Apr 2000 with mean trade price < \$3	41	3%	1168
Trading data available for June 5-9	17	1%	1151
No multiple classes of the same stock	10	1%	1141

Table 3  
Comparison of Nasdaq/NYSE Matched Samples

Statistics are equally-weighted averages of the stocks in the group. Standard deviations of the statistics for the stocks in each group are shown in parenthesis.

	Nasdaq	NYSE	Differences	
			Average	P-value*
<u>Panel A: 221 matched pairs</u>				
Closing Price per share (6/9/00)	30.73 (37.00)	28.46 (28.61)	2.27 (20.19)	.096
Market Capitalization in mils. (6/9/00)	11,958 (52,792)	10,302 (30,696)	1,656 (27,475)	.371
Weekly Volatility in pct. (12/97-6/00)	0.123 (.077)	0.095 (.027)	.028 (.053)	.000
Adjusted dollar vol. in mils (6/5-6/9/00)	81.3 (257)	47.1 (122)	34.2 (153)	.001
<u>Panel B: 58 “well” matched pairs**</u>				
Closing Price per share (6/9/00)	26.85 (20.12)	26.34 (18.78)	.51 (4.48)	.390
Market Capitalization in mils. (6/9/00)	5,356 (18,235)	5,001 (16,654)	355 (1,761)	.129
Weekly Volatility in pct. (12/97-6/00)	0.075 (.028)	0.075 (.023)	.000 (.010)	.796
Adjusted dollar vol. in mils (6/5-6/9/00)	29.6 (86)	26.7 (76)	2.9 (12)	.075

\*The p-value is based on the null hypothesis that the mean of the pair-wise differences is zero.

\*\* Less than 70% total absolute differences across the four matching criteria.

Table 4  
 Statistics for Subgroups of the 221 Matched Pairs of Stocks

Statistics are equally-weighted averages of the stocks in the group. Standard deviations of the statistics for the differences across stocks in each group are shown in parenthesis.

	Size Category				
	All	Very Large	Large	Middle	Small
Number of Pairs	221	25	33	72	91
<u>Closing Share Price (6/9/00)</u>					
Nasdaq	30.73	92.99	56.90	23.56	9.81
NYSE	28.46	77.40	49.68	24.51	10.44
Difference	2.27	15.60	7.22	-0.96	-0.63
	(20.19)	(41.84)	(31.10)	(9.04)	(6.80)
<u>Market Capitalizations (mils) (6/9/00)</u>					
Nasdaq	11,958	99,243	3,591	469	103
NYSE	10,302	76,412	8,103	863	406
Difference	1,656*	22,831	-4,512	-394*	-303*
	(27,475)	(76,520)	(19,559)	(1,251)	(933)
<u>Standard Deviation of Weekly Return (12/31/97-6/9/00)</u>					
Nasdaq	0.123	0.100	0.105	0.113	0.143
NYSE	0.094	0.078	0.087	0.086	0.108
Difference	0.028*	0.022*	0.019*	0.027*	0.034*
	(0.053)	(0.030)	(0.025)	(0.039)	(0.071)
<u>Adjusted Dollar Trading Volume (mils) (6/5/00-6/9/00)</u>					
Nasdaq	81.3	628.8	55.6	4.8	0.8
NYSE	47.1	341.7	43.0	4.8	1.0
Difference	34.3*	287.0*	12.6	-0.1	-0.2
	(152.5)	(359.1)	(82.2)	(1.2)	(0.9)

\* Statistically significant at the 5% level in a two-tailed test.

Table 5  
 Statistics for Subgroups of the 58 “Closest matched” Matched Pairs of Stocks

Statistics are equally-weighted averages of the stocks in the group. Standard deviations of the statistics for the differences across stocks in each group are shown in parenthesis.

	Size Category				
	All	Very Large	Large	Middle	Small
Number of Pairs	58	5	14	26	13
<u>Closing Share Price (6/9/00)</u>					
Nasdaq	26.85	57.68	39.78	22.21	10.34
NYSE	26.34	58.89	36.12	22.88	10.21
Difference	0.51 (4.48)	-1.21* (9.01)	3.66 (6.10)	-0.67 (2.27)	0.14 (1.06)
<u>Market Capitalizations (mils) (6/9/00)</u>					
Nasdaq	5,356	50,115	3,330	447	144
NYSE	5,001	45,349	3,434	501	169
Difference	356 (1,761)	4,766 (3,973)	-104 (717)	-54* (118)	-26* (33)
<u>Standard Deviation of Weekly Return (12/31/97-6/9/00)</u>					
Nasdaq	0.075	0.073	0.081	0.069	0.083
NYSE	0.075	0.077	0.078	0.068	0.083
Difference	0.000 (0.010)	-0.004 (0.012)	0.003 (0.012)	0.000 (0.009)	-0.001 (0.011)
<u>Adjusted Dollar Trading Volume (mils) (6/5/00-6/9/00)</u>					
Nasdaq	29.6	258.3	26.4	1.9	0.5
NYSE	26.7	226.1	25.7	2.0	0.5
Difference	2.9 (12.2)	32.2 (28.7)	0.8 (5.7)	-0.1 (0.4)	0.0 (0.1)

\* Statistically significant at the 5% level in a two-tailed test.

Table 6  
Dollar Effective Spreads for 100-499 Share Market Orders

	Size Category			
	Very Large	Large	Middle	Small
<b>Test 1 Closest Matched Pairs</b>				
Number of Pairs (54 total)	5	13	25	11
Average Across Nasdaq Stocks	0.071	0.150	0.206	0.164
Average Across NYSE Stocks	0.083	0.093	0.097	0.088
Difference	-0.012	0.057 **	0.110 ***	0.076 *
<b>Test 2 All Matched Pairs</b>				
Number of Pairs (210 total)	25	32	71	82
Average Across Nasdaq Stocks	0.097	0.211	0.199	0.171
Average Across NYSE Stocks	0.087	0.100	0.093	0.079
Difference	0.010	0.110 ***	0.106 ***	0.092 ***
<b>Other Tests of the Difference</b>				
Test 3 (210 pairs, regression)	-0.009	0.050 **	0.101 ***	0.089 ***
Test 4 (same as 3 except 1-yr volatility)	-0.013	0.037 *	0.096 ***	0.087 ***
Test 5 (same as 3 plus listing control)	-0.006	0.049 **	0.090 ***	0.053 ***
Number of NYSE stocks in tests 6-10	33	490	336	71
Test 6 regression	0.004	0.097 ***	0.114 ***	0.076 ***
Test 7 (same as 6 except 1-yr volatility)	0.000	0.094 ***	0.115 ***	0.073 ***
Test 8 (same as 6 plus SIC code)	-0.006	0.090 ***	0.125 ***	0.076 ***
Test 9 (same as 6 plus listing control)	0.004	0.091 ***	0.110 ***	0.068 ***
Test 10 (same as 6 plus P/E)	0.004	0.091 ***	0.113 ***	0.071 ***
Test 11 (separate slope coefficients)	-0.005	0.103 ***	0.104 ***	0.087 ***
Test 12 (individual orders)	0.007	0.095 ***	0.118 ***	0.076 ***

\* Statistically significant at the 10% level in a two-tailed test.

\*\* Statistically significant at the 5% level in a two-tailed test.

\*\*\* Statistically significant at the 1% level in a two-tailed test.

Table 7  
Dollar Effective Spreads for 500-1999 Share Market Orders

	Size Category			
	Very Large	Large	Middle	Small
<b>Test 1 Closest Matched Pairs</b>				
Number of Pairs (47 total)	5	13	22	7
Average Across Nasdaq Stocks	0.086	0.168	0.276	0.131
Average Across NYSE Stocks	0.117	0.142	0.139	0.097
Difference	-0.031	0.026	0.136 **	0.034
<b>Test 2 All Matched Pairs</b>				
Number of Pairs (192 total)	25	32	63	72
Average Across Nasdaq Stocks	0.148	0.250	0.234	0.170
Average Across NYSE Stocks	0.125	0.148	0.130	0.100
Difference	0.023	0.102 ***	0.104 ***	0.070 ***
<b>Other Tests of the Difference</b>				
Test 3 (192 pairs, regression)	-0.025	0.018	0.116 ***	0.068 ***
Test 4 (same as 3 except 1-yr volatility)	-0.026	0.005	0.114 ***	0.064 ***
Test 5 (same as 3 plus listing control)	-0.017	0.017	0.097 ***	0.044 **
Number of NYSE stocks in tests 6-10	33	490	327	74
Test 6 regression	0.001	0.082 ***	0.103 ***	0.050 ***
Test 7 (same as 6 except 1-yr volatility)	-0.007	0.077 ***	0.099 ***	0.046 ***
Test 8 (same as 6 plus SIC code)	-0.010	0.069 ***	0.107 ***	0.063 ***
Test 9 (same as 6 plus listing control)	0.001	0.078 ***	0.098 ***	0.041 ***
Test 10 (same as 6 plus P/E)	-0.001	0.073 ***	0.100 ***	0.044 ***
Test 11 (separate slope coefficients)	0.004	0.090 ***	0.101 ***	0.056 ***
Test 12 (individual orders)	-0.003	0.074 ***	0.091 ***	0.046 ***

\* Statistically significant at the 10% level in a two-tailed test.

\*\* Statistically significant at the 5% level in a two-tailed test.

\*\*\* Statistically significant at the 1% level in a two-tailed test.

Table 8  
Dollar Effective Spreads for 2000-4999 Share Market Orders

	Size Category			
	Very Large	Large	Middle	Small
<b>Test 1 Closest Matched Pairs</b>				
Number of Pairs (25 total)	5	11	7	2
Average Across Nasdaq Stocks	0.142	0.244	0.299	0.176
Average Across NYSE Stocks	0.184	0.190	0.144	0.117
Difference	-0.041	0.055	0.154 **	0.059
<b>Test 2 All Matched Pairs</b>				
Number of Pairs (114 total)	25	27	36	26
Average Across Nasdaq Stocks	0.220	0.440	0.259	0.193
Average Across NYSE Stocks	0.181	0.222	0.151	0.141
Difference	0.039 *	0.218 ***	0.108 ***	0.052 **
<b>Other Tests of the Difference</b>				
Test 3 (114 pairs, regression)	-0.019	0.007	0.129 ***	-0.001
Test 4 (same as 3 except 1-yr volatility)	-0.009	0.034	0.148 ***	0.002
Test 5 (same as 3 plus listing control)	-0.016	0.004	0.085 *	-0.007
Number of NYSE stocks in tests 6-10	33	466	196	32
Test 6 regression	0.008	0.174 ***	0.066	0.064
Test 7 (same as 6 except 1-yr volatility)	0.005	0.164 ***	0.083 *	0.059
Test 8 (same as 6 plus SIC code)	-0.010	0.154 ***	0.065	0.159 *
Test 9 (same as 6 plus listing control)	0.008	0.156 ***	0.057	0.057
Test 10 (same as 6 plus P/E)	0.007	0.162 ***	0.064	0.077
Test 11 (separate slope coefficients)	0.014	0.215 ***	0.030	0.088 *
Test 12 (individual orders)	0.007	0.174 ***	0.104 ***	0.068 **

na denotes “not applicable”

\* Statistically significant at the 10% level in a two-tailed test.

\*\* Statistically significant at the 5% level in a two-tailed test.

\*\*\* Statistically significant at the 1% level in a two-tailed test.

Table 9  
Dollar Realized Spreads for 100-499 Share Market Orders

	Size Category			
	Very Large	Large	Middle	Small
<b>Test 1 Closest Matched Pairs</b>				
Number of Pairs (56 total)	5	13	26	12
Average Across Nasdaq Stocks	0.025	0.081	0.177	0.155
Average Across NYSE Stocks	0.025	0.013	0.028	0.048
Difference	0.000	0.068 **	0.149 ***	0.107 ***
<b>Test 2 All Matched Pairs</b>				
Number of Pairs (214 total)	25	32	72	85
Average Across Nasdaq Stocks	0.022	0.135	0.158	0.151
Average Across NYSE Stocks	0.026	0.020	0.032	0.049
Difference	-0.004	0.116 ***	0.126 ***	0.102 ***
<b>Other Tests of the Difference</b>				
Test 3 (214 pairs, regression)	-0.023 *	0.075 ***	0.135 ***	0.117 ***
Test 4 (same as 3 except 1-yr volatility)	-0.027 **	0.071 ***	0.140 ***	0.114 ***
Test 5 (same as 3 plus listing control)	-0.022	0.070 ***	0.129 ***	0.079 ***
Number of NYSE stocks in tests 6-10	33	490	340	75
Test 6 regression	-0.006	0.107 ***	0.128 ***	0.099 ***
Test 7 (same as 6 except 1-yr volatility)	-0.011	0.108 ***	0.132 ***	0.096 ***
Test 8 (same as 6 plus SIC code)	0.000	0.108 ***	0.138 ***	0.092 ***
Test 9 (same as 6 plus listing control)	-0.006	0.093 ***	0.125 ***	0.090 ***
Test 10 (same as 6 plus P/E)	-0.005	0.109 ***	0.128 ***	0.093 ***
Test 11 (separate slope coefficients)	-0.002	0.117 ***	0.118 ***	0.117 ***
Test 12 (individual orders)	0.004	0.087 ***	0.121 ***	0.090 ***

\* Statistically significant at the 10% level in a two-tailed test.

\*\* Statistically significant at the 5% level in a two-tailed test.

\*\*\* Statistically significant at the 1% level in a two-tailed test.

Table 10  
Dollar Realized Spreads for 500-1999 Share Market Orders

	Size Category			
	Very Large	Large	Middle	Small
<b>Test 1 Closest Matched Pairs</b>				
Number of Pairs (49 total)	5	13	22	9
Average Across Nasdaq Stocks	0.046	0.058	0.095	0.087
Average Across NYSE Stocks	0.015	0.009	0.011	0.037
Difference	0.030 *	0.050 ***	0.084 ***	0.051 *
<b>Test 2 All Matched Pairs</b>				
Number of Pairs (195 total)	25	32	63	75
Average Across Nasdaq Stocks	0.061	0.112	0.088	0.108
Average Across NYSE Stocks	0.014	0.018	0.011	0.041
Difference	0.047 ***	0.094 ***	0.077 **	0.067 ***
<b>Other Tests of the Difference</b>				
Test 3 (195 pairs, regression)	0.000	0.059 ***	0.095 ***	0.064 ***
Test 4 (same as 3 except 1-yr volatility)	0.008	0.055 ***	0.096 ***	0.061 ***
Test 5 (same as 3 plus listing control)	0.010	0.058 ***	0.102 ***	0.061 ***
Number of NYSE stocks in tests 6-10	33	490	334	76
Test 6 regression	0.030 ***	0.097 ***	0.076 ***	0.067 ***
Test 7 (same as 6 except 1-yr volatility)	0.028 **	0.097 ***	0.079 ***	0.065 ***
Test 8 (same as 6 plus SIC code)	0.036 ***	0.095 ***	0.079 ***	0.067 ***
Test 9 (same as 6 plus listing control)	0.030 ***	0.087 ***	0.076 ***	0.065 ***
Test 10 (same as 6 plus P/E)	0.032 ***	0.096 ***	0.083 ***	0.058 ***
Test 11 (separate slope coefficients)	0.037 ***	0.101 ***	0.075 **	0.079 ***
Test 12 (individual orders)	0.023 *	0.075 ***	0.063 *	0.063 ***

\* Statistically significant at the 10% level in a two-tailed test.

\*\* Statistically significant at the 5% level in a two-tailed test.

\*\*\* Statistically significant at the 1% level in a two-tailed test.

Table 11  
Dollar Realized Spreads for 2000-4999 Share Market Orders

	Size Category			
	Very Large	Large	Middle	Small
<b>Test 1 Closest Matched Pairs</b>				
Number of Pairs (25 total)	5	11	7	2
Average Across Nasdaq Stocks	0.055	0.112	0.208	0.128
Average Across NYSE Stocks	0.032	0.032	-0.050	0.033
Difference	0.024	0.080	0.258 *	0.095 *
<b>Test 2 All Matched Pairs</b>				
Number of Pairs (121 total)	25	27	37	32
Average Across Nasdaq Stocks	0.122	0.166	0.101	0.099
Average Across NYSE Stocks	0.030	0.052	0.009	0.047
Difference	0.092	0.114 ***	0.092 ***	0.052 **
<b>Other Tests of the Difference</b>				
Test 3 (121 pairs, regression)	0.132 *	0.052	0.108 **	0.062
Test 4 (same as 3 except 1-yr volatility)	0.144 **	0.051	0.091 *	0.068
Test 5 (same as 3 plus listing control)	0.156 **	0.050	0.044	0.033
Number of NYSE stocks in tests 6-10	33	478	245	54
Test 6 regression	0.077	0.134 ***	0.088 **	0.077 ***
Test 7 (same as 6 except 1-yr volatility)	0.078	0.127 ***	0.091 ***	0.076 ***
Test 8 (same as 6 plus SIC code)	0.042	0.125 ***	0.072 **	0.086 ***
Test 9 (same as 6 plus listing control)	0.077	0.120 ***	0.083 ***	0.072 ***
Test 10 (same as 6 plus P/E)	0.068	0.132 ***	0.084 ***	0.076 **
Test 11 (separate slope coefficients)	0.098 *	0.148 ***	0.085 **	0.070 **
Test 12 (individual orders)	0.066	0.130 ***	0.070 ***	0.061 ***

\* Statistically significant at the 10% level in a two-tailed test.

\*\* Statistically significant at the 5% level in a two-tailed test.

\*\*\* Statistically significant at the 1% level in a two-tailed test.

Table 12  
Dollar Quoted Spreads at the Time of Market Order Arrival

	Size Category			
	Very Large	Large	Middle	Small
<b>Test 1 Closest Matched Pairs</b>				
Number of Pairs (57 total)	5	13	26	13
Average Across Nasdaq Stocks	0.079	0.149	0.211	0.154
Average Across NYSE Stocks	0.133	0.148	0.157	0.138
Difference	-0.054 **	0.001	0.053 **	0.016
<b>Test 2 All Matched Pairs</b>				
Number of Pairs (220 total)	25	32	72	91
Average Across Nasdaq Stocks	0.097	0.209	0.200	0.170
Average Across NYSE Stocks	0.143	0.163	0.149	0.124
Difference	-0.046 ***	0.046 **	0.051 ***	0.046 ***
<b>Other Tests of the Difference</b>				
Test 3 (220 pairs, regression)	-0.055 ***	-0.002	0.042 ***	0.042 **
Test 4 (same as 3 except 1-yr volatility)	-0.062 ***	-0.016	0.041 ***	0.039 **
Test 5 (same as 3 plus listing control)	-0.052 ***	-0.002	0.033 **	0.015
Number of NYSE stocks in tests 6-10	33	490	340	77
Test 6 regression	-0.048 ***	0.038 **	0.059 ***	0.029 ***
Test 7 (same as 6 except 1-yr volatility)	-0.053 ***	0.034 **	0.058 ***	0.027 **
Test 8 (same as 6 plus SIC code)	-0.051 ***	0.029 *	0.060 ***	0.025 *
Test 9 (same as 6 plus listing control)	-0.048 ***	0.033 **	0.055 ***	0.022 **
Test 10 (same as 6 plus P/E)	-0.049 ***	0.031 **	0.056 ***	0.023 *
Test 11 (separate slope coefficients)	-0.059 ***	0.043 ***	0.053 ***	0.036 ***

\* Statistically significant at the 10% level in a two-tailed test.

\*\* Statistically significant at the 5% level in a two-tailed test.

\*\*\* Statistically significant at the 1% level in a two-tailed test.

Table 13  
Dollar Adjusted Spreads for 100-499 Share Marketable Limit Orders

	Size Category			
	Very Large	Large	Middle	Small
<b>Test 1 Closest Matched Pairs</b>				
Number of Pairs (49 total)	5	14	23	7
Average Across Nasdaq Stocks	0.080	0.168	0.193	0.183
Average Across NYSE Stocks	0.087	0.102	0.114	0.093
Difference	-0.007	0.067 **	0.079 ***	0.090
<b>Test 2 All Matched Pairs</b>				
Number of Pairs (185 total)	25	33	67	60
Average Across Nasdaq Stocks	0.112	0.219	0.181	0.156
Average Across NYSE Stocks	0.108	0.108	0.102	0.082
Difference	0.004	0.110 ***	0.079 ***	0.074 ***
<b>Other Tests of the Difference</b>				
Test 3 (185 pairs, regression)	-0.014	0.046 *	0.075 ***	0.082 **
Test 4 (same as 3 except 1-yr volatility)	-0.019	0.031	0.076 ***	0.080 **
Test 5 (same as 3 plus listing control)	-0.007	0.045 *	0.059 ***	0.043 *
Number of NYSE stocks in tests 6-10	33	490	326	53
Test 6 regression	-0.004	0.101 ***	0.074 ***	0.058 ***
Test 7 (same as 6 except 1-yr volatility)	-0.009	0.098 ***	0.073 ***	0.055 ***
Test 8 (same as 6 plus SIC code)	-0.015	0.090 ***	0.080 ***	0.056 ***
Test 9 (same as 6 plus listing control)	-0.004	0.094 ***	0.068 ***	0.045 ***
Test 10 (same as 6 plus P/E)	-0.005	0.096 ***	0.073 ***	0.041 ***
Test 11 (separate slope coefficients)	-0.014	0.108 ***	0.076 ***	0.081 ***
Test 12 (individual orders)	0.002	0.085 ***	0.084 ***	0.056 ***

\* Statistically significant at the 10% level in a two-tailed test.

\*\* Statistically significant at the 5% level in a two-tailed test.

\*\*\* Statistically significant at the 1% level in a two-tailed test.

Table 14  
Dollar Adjusted Spreads for 500-1999 Share Marketable Limit Orders

	Size Category			
	Very Large	Large	Middle	Small
<b>Test 1 Closest Matched Pairs</b>				
Number of Pairs (54 total)	5	14	25	10
Average Across Nasdaq Stocks	0.092	0.175	0.225	0.161
Average Across NYSE Stocks	0.124	0.167	0.150	0.123
Difference	-0.031	0.008	0.075 **	0.038
<b>Test 2 All Matched Pairs</b>				
Number of Pairs (203 total)	25	33	68	77
Average Across Nasdaq Stocks	0.166	0.251	0.236	0.161
Average Across NYSE Stocks	0.143	0.184	0.138	0.107
Difference	0.023	0.067 *	0.098 ***	0.054 ***
<b>Other Tests of the Difference</b>				
Test 3 (203 pairs, regression)	-0.028	0.009	0.100 ***	0.049 **
Test 4 (same as 3 except 1-yr volatility)	-0.017	-0.031	0.097 ***	0.047 **
Test 5 (same as 3 plus listing control)	-0.027	0.012	0.074 ***	0.024
Number of NYSE stocks in tests 6-10	33	490	330	68
Test 6 regression	-0.006	0.067 ***	0.089 ***	0.039 ***
Test 7 (same as 6 except 1-yr volatility)	-0.012	0.061 ***	0.080 ***	0.037 ***
Test 8 (same as 6 plus SIC code)	-0.014	0.051 **	0.092 ***	0.044 ***
Test 9 (same as 6 plus listing control)	-0.006	0.063 ***	0.080 ***	0.031 ***
Test 10 (same as 6 plus P/E)	-0.008	0.057 **	0.083 ***	0.034 ***
Test 11 (separate slope coefficients)	0.013	0.077 ***	0.092 ***	0.059 ***
Test 12 (individual orders)	-0.006	0.074 ***	0.098 ***	0.039 ***

\* Statistically significant at the 10% level in a two-tailed test.

\*\* Statistically significant at the 5% level in a two-tailed test.

\*\*\* Statistically significant at the 1% level in a two-tailed test.

Table 15  
Dollar Adjusted Spreads for 2000-4999 Share Marketable Limit Orders

	Size Category			
	Very Large	Large	Middle	Small
<b>Test 1 Closest Matched Pairs</b>				
Number of Pairs (32 total)	5	12	13	2
Average Across Nasdaq Stocks	0.123	0.229	0.273	0.414
Average Across NYSE Stocks	0.170	0.188	0.196	0.188
Difference	-0.046	0.041	0.076	0.226
<b>Test 2 All Matched Pairs</b>				
Number of Pairs (148 total)	25	30	50	43
Average Across Nasdaq Stocks	0.227	0.360	0.278	0.207
Average Across NYSE Stocks	0.186	0.234	0.181	0.132
Difference	0.041	0.126 **	0.097 ***	0.075 ***
<b>Other Tests of the Difference</b>				
Test 3 (148 pairs, regression)	-0.026	-0.009	0.063	0.136
Test 4 (same as 3 except 1-yr volatility)	-0.018	-0.038	0.065 *	0.134
Test 5 (same as 3 plus listing control)	-0.021	-0.018	0.018	0.093 *
Number of NYSE stocks in tests 6-10	33	479	254	48
Test 6 regression	-0.005	0.094 ***	0.070 **	0.042
Test 7 (same as 6 except 1-yr volatility)	-0.009	0.090 **	0.064 **	0.038
Test 8 (same as 6 plus SIC code)	-0.004	0.076 **	0.059 **	0.049
Test 9 (same as 6 plus listing control)	-0.005	0.081 **	0.061 **	0.025
Test 10 (same as 6 plus P/E)	-0.007	0.087 **	0.055 *	0.035
Test 11 (separate slope coefficients)	0.011	0.122 ***	0.070 *	0.052 **
Test 12 (individual orders)	-0.007	0.120 ***	0.081 **	0.071 ***

\* Statistically significant at the 10% level in a two-tailed test.

\*\* Statistically significant at the 5% level in a two-tailed test.

\*\*\* Statistically significant at the 1% level in a two-tailed test.

Table 16  
Dollar Realized Spreads for 100-499 Share Marketable Limit Orders

	Size Category			
	Very Large	Large	Middle	Small
<b>Test 1 Closest Matched Pairs</b>				
Number of Pairs (49 total)	5	14	24	9
Average Across Nasdaq Stocks	0.013	-0.009	0.106	0.138
Average Across NYSE Stocks	0.002	0.022	0.035	0.058
Difference	0.011	-0.030	0.072 ***	0.081
<b>Test 2 All Matched Pairs</b>				
Number of Pairs (185 total)	25	33	69	69
Average Across Nasdaq Stocks	0.020	0.037	0.078	0.108
Average Across NYSE Stocks	0.007	0.019	0.032	0.050
Difference	0.013	0.018	0.046 ***	0.058 ***
<b>Other Tests of the Difference</b>				
Test 3 (185 pairs, regression)	0.012	-0.013	0.058 ***	0.088 **
Test 4 (same as 3 except 1-yr volatility)	0.008	0.007	0.058 ***	0.091 **
Test 5 (same as 3 plus listing control)	0.008	-0.014	0.062 ***	0.067 **
Number of NYSE stocks in tests 6-10	33	490	334	65
Test 6 regression	0.010	0.023	0.043 ***	0.063 ***
Test 7 (same as 6 except 1-yr volatility)	0.011	0.026	0.047 ***	0.063 ***
Test 8 (same as 6 plus SIC code)	0.002	0.025	0.049 ***	0.079 ***
Test 9 (same as 6 plus listing control)	0.010	0.017	0.045 ***	0.056 ***
Test 10 (same as 6 plus P/E)	0.010	0.027	0.047 ***	0.050 ***
Test 11 (separate slope coefficients)	0.011	0.024	0.033 ***	0.066 ***
Test 12 (individual orders)	0.011	0.017	0.021	0.059 ***

\* Statistically significant at the 10% level in a two-tailed test.

\*\* Statistically significant at the 5% level in a two-tailed test.

\*\*\* Statistically significant at the 1% level in a two-tailed test.

Table 17  
Dollar Realized Spreads for 500-1999 Share Marketable Limit Orders

	Size Category			
	Very Large	Large	Middle	Small
<b>Test 1 Closest Matched Pairs</b>				
Number of Pairs (58 total)	5	14	26	13
Average Across Nasdaq Stocks	0.015	0.020	0.090	0.093
Average Across NYSE Stocks	-0.001	-0.010	0.018	0.035
Difference	0.015	0.030	0.072 ***	0.058 *
<b>Test 2 All Matched Pairs</b>				
Number of Pairs (208 total)	25	33	69	81
Average Across Nasdaq Stocks	0.007	0.028	0.043	0.066
Average Across NYSE Stocks	0.004	0.028	0.013	0.035
Difference	0.003	0.000	0.030 *	0.032 ***
<b>Other Tests of the Difference</b>				
Test 3 (208 pairs, regression)	0.020 *	0.040	0.043 **	0.041 **
Test 4 (same as 3 except 1-yr volatility)	0.014	-0.007	0.041 **	0.040 **
Test 5 (same as 3 plus listing control)	0.019 *	0.042	0.046 ***	0.028 *
Number of NYSE stocks in tests 6-10	33	490	337	73
Test 6 regression	0.009	0.014	0.036 **	0.031 ***
Test 7 (same as 6 except 1-yr volatility)	0.006	0.014	0.038 ***	0.031 ***
Test 8 (same as 6 plus SIC code)	-0.006	0.003	0.033 **	0.025 **
Test 9 (same as 6 plus listing control)	0.009	0.013	0.037 ***	0.026 **
Test 10 (same as 6 plus P/E)	0.009	0.015	0.035 **	0.029 **
Test 11 (separate slope coefficients)	0.000	0.016	0.033 **	0.037 **
Test 12 (individual orders)	-0.002	0.014	0.004	0.040 ***

\* Statistically significant at the 10% level in a two-tailed test.

\*\* Statistically significant at the 5% level in a two-tailed test.

\*\*\* Statistically significant at the 1% level in a two-tailed test.

Table 18  
Dollar Realized Spreads for 2000-4999 Share Marketable Limit Orders

	Size Category			
	Very Large	Large	Middle	Small
<b>Test 1 Closest Matched Pairs</b>				
Number of Pairs (37 total)	5	13	16	3
Average Across Nasdaq Stocks	-0.010	0.043	0.006	0.204
Average Across NYSE Stocks	0.009	-0.015	-0.038	0.037
Difference	-0.019	0.058 *	0.044	0.167
<b>Test 2 All Matched Pairs</b>				
Number of Pairs (159 total)	25	31	55	48
Average Across Nasdaq Stocks	0.016	0.066	0.005	0.034
Average Across NYSE Stocks	0.011	0.016	-0.001	0.021
Difference	0.006	0.050	0.006	0.013
<b>Other Tests of the Difference</b>				
Test 3 (159 pairs, regression)	-0.016	0.084 **	0.010	0.062
Test 4 (same as 3 except 1-yr volatility)	-0.011	0.042	0.011	0.066
Test 5 (same as 3 plus listing control)	-0.012	0.082 **	0.010	0.013
Number of NYSE stocks in tests 6-10	33	485	289	63
Test 6 regression	0.015	0.052 **	-0.010	0.012
Test 7 (same as 6 except 1-yr volatility)	0.014	0.050 **	-0.009	0.009
Test 8 (same as 6 plus SIC code)	-0.006	0.039 *	-0.012	0.025
Test 9 (same as 6 plus listing control)	0.015	0.048 **	-0.006	0.008
Test 10 (same as 6 plus P/E)	0.015	0.049 **	-0.010	0.007
Test 11 (separate slope coefficients)	-0.005	0.049 **	-0.010	-0.005
Test 12 (individual orders)	-0.016	-0.011	-0.028	0.011

\* Statistically significant at the 10% level in a two-tailed test.

\*\* Statistically significant at the 5% level in a two-tailed test.

\*\*\* Statistically significant at the 1% level in a two-tailed test.

Table 19  
Average Execution Times (Seconds) for 100-499 Share Market Orders

	Size Category			
	Very Large	Large	Middle	Small
<b>Test 1 Closely Matched Pairs</b>				
Number of Pairs (54 total)	5	13	25	11
Average Across Nasdaq Stocks	3.4	6.0	7.8	4.5
Average Across NYSE Stocks	17.1	15.8	26.5	15.8
Difference	-13.7 ***	-9.8 ***	-18.7 ***	-11.3 ***
<b>Test 2 All Matched Pairs</b>				
Number of Pairs (210 total)	25	32	71	82
Average Across Nasdaq Stocks	1.3	5.9	6.0	3.9
Average Across NYSE Stocks	17.4	17.3	21.6	22.5
Difference	-16.1 ***	-11.3 ***	-15.6 ***	-18.6 ***
<b>Other Tests of the Difference</b>				
Test 3 (210 pairs, regression)	-20.5 ***	-10.5 ***	-15.7 ***	-12.2 ***
Test 4 (same as 3 except 1-yr volatility)	-19.4 ***	-11.9 ***	-15.6 ***	-13.2 ***
Test 5 (same as 3 plus listing control)	-20.9 ***	-10.6 ***	-16.1 ***	-12.6 ***
Number of NYSE stocks in tests 6-10	33	490	336	71
Test 6 regression	-16.8 ***	-14.7 ***	-14.7 ***	-18.0 ***
Test 7 (same as 6 except 1-yr volatility)	-17.5 ***	-14.7 ***	-14.5 ***	-18.3 ***
Test 8 (same as 6 plus SIC code)	-18.1 ***	-14.2 ***	-14.3 ***	-18.5 ***
Test 9 (same as 6 plus listing control)	-16.9 ***	-13.9 ***	-13.8 ***	-18.1 ***
Test 10 (same as 6 plus P/E)	-16.7 ***	-14.7 ***	-14.6 ***	-17.0 ***
Test 11 (separate slope coefficients)	-19.9 ***	-15.2 ***	-13.7 ***	-20.6 ***

The analysis reflects the time until the last execution for orders with multiple executions.

\* Statistically significant at the 10% level in a two-tailed test.

\*\* Statistically significant at the 5% level in a two-tailed test.

\*\*\* Statistically significant at the 1% level in a two-tailed test.

Table 20  
Average Execution Times (Seconds) for 500-1999 Share Market Orders

	Size Category			
	Very Large	Large	Middle	Small
<b>Test 1 Closely Matched Pairs</b>				
Number of Pairs (51 total)	5	13	22	7
Average Across Nasdaq Stocks	17.3	24.0	25.0	16.8
Average Across NYSE Stocks	20.6	17.4	27.9	20.6
Difference	-3.3	6.6 **	-2.9	-3.8
<b>Test 2 All Matched Pairs</b>				
Number of Pairs (192 total)	25	32	63	72
Average Across Nasdaq Stocks	20.8	25.0	22.5	18.6
Average Across NYSE Stocks	20.7	19.0	24.9	26.4
Difference	0.0	6.0 **	-2.4	-7.8
<b>Other Tests of the Difference</b>				
Test 3 (192 pairs, regression)	-9.4 *	5.5 **	-0.7	-8.9
Test 4 (same as 3 except 1-yr volatility)	-6.8	4.2 *	-1.5	-10.7
Test 5 (same as 3 plus listing control)	-9.1	4.9 *	-0.2	-3.7
Number of NYSE stocks in tests 6-10	33	490	327	74
Test 6 regression	-3.8	0.5	-2.4	-8.7 ***
Test 7 (same as 6 except 1-yr volatility)	-5.0	0.3	-0.4	-8.7 ***
Test 8 (same as 6 plus SIC code)	-5.1	1.5	-8.9	-9.1 **
Test 9 (same as 6 plus listing control)	-3.7	0.9	-5.9	-7.4 **
Test 10 (same as 6 plus p/e ratio)	-3.9	0.4	-8.2	-10.7 ***
Test 11 (separate slope coefficients)	-4.1	1.3	-3.1	-0.4

The analysis reflects the time until the last execution for orders with multiple executions.

\* Statistically significant at the 10% level in a two-tailed test.

\*\* Statistically significant at the 5% level in a two-tailed test.

\*\*\* Statistically significant at the 1% level in a two-tailed test.

Table 21  
Average Execution Times (Seconds) for 2000-4999 Share Market Orders

	Size Category			
	Very Large	Large	Middle	Small
<b>Test 1 Closely Matched Pairs</b>				
Number of Pairs (25 total)	5	11	7	2
Average Across Nasdaq Stocks	53.2	73.3	91.4	72.9
Average Across NYSE Stocks	24.3	28.1	50.2	25.6
Difference	29.0 *	45.2 ***	41.2	47.3 **
<b>Test 2 All Matched Pairs</b>				
Number of Pairs (114 total)	25	27	36	26
Average Across Nasdaq Stocks	53.3	89.2	83.8	82.4
Average Across NYSE Stocks	23.7	30.7	39.4	24.8
Difference	29.5 ***	58.5 ***	44.4 ***	57.6 ***
<b>Other Tests of the Difference</b>				
Test 3 (114 pairs, regression)	27.7 ***	50.0 ***	43.5 **	59.6 ***
Test 4 (same as 3 except 1-yr volatility)	26.6 ***	53.0 ***	54.0 ***	55.3 ***
Test 5 (same as 3 plus listing control)	27.7 ***	51.3 ***	29.0 **	68.6 ***
Number of NYSE stocks in tests 6-10	33	466	196	32
Test 6 regression	30.7 ***	30.0 *	68.4 ***	44.8 ***
Test 7 (same as 6 except 1-yr volatility)	28.9 ***	30.2	63.8 ***	43.7 ***
Test 8 (same as 6 plus SIC code)	24.5 ***	27.4 *	56.7 ***	46.8 ***
Test 9 (same as 6 plus listing control)	30.7 ***	31.3 *	69.7 ***	50.3 ***
Test 10 (same as 6 plus p/e ratio)	30.9 ***	30.2 *	60.2 ***	50.1 ***
Test 11 (separate slope coefficients)	25.4 ***	30.1	84.2 **	61.1 ***

The analysis reflects the time until the last execution for orders with multiple executions.

\* Statistically significant at the 10% level in a two-tailed test.

\*\* Statistically significant at the 5% level in a two-tailed test.

\*\*\* Statistically significant at the 1% level in a two-tailed test.

Table 22  
Average Execution Rates for 100-499 Share Marketable Limit Orders

	Size Category			
	Very Large	Large	Middle	Small
<b>Test 1 Closely Matched Pairs</b>				
Number of Pairs (49 total)	5	14	23	7
Average Across Nasdaq Stocks	80.0%	79.6%	82.1%	85.3%
Average Across NYSE Stocks	89.4%	92.4%	95.6%	98.0%
Difference	-9.3% ***	-12.8% ***	-13.4% ***	-12.7% *
<b>Test 2 All Matched Pairs</b>				
Number of Pairs (185 total)	25	33	67	60
Average Across Nasdaq Stocks	68.3%	72.8%	72.8%	71.1%
Average Across NYSE Stocks	85.3%	91.3%	95.5%	97.2%
Difference	-17.0% ***	-18.5% ***	-22.7% ***	-26.1% ***
<b>Other Tests of the Difference</b>				
Test 3 (185 pairs, regression)	-9.3% ***	-11.4% ***	-17.9% ***	-12.5% ***
Test 4 (same as 3 except 1-yr volatility)	-12.0% ***	-12.9% ***	-17.7% ***	-11.9% ***
Test 5 (same as 3 plus listing control)	-9.2% ***	-11.7% ***	-16.1% ***	-13.6% ***
Number of NYSE stocks in tests 6-10	33	490	326	53
Test 6 regression	-11.1% ***	-18.0% ***	-19.8% ***	-21.8% ***
Test 7 (same as 6 except 1-yr volatility)	-12.1% ***	-18.5% ***	-19.0% ***	-22.4% ***
Test 8 (same as 6 plus SIC code)	-9.8% ***	-17.5% ***	-20.2% ***	-18.4% ***
Test 9 (same as 6 plus listing control)	-11.0% ***	-17.6% ***	-19.5% ***	-21.4% ***
Test 10 (same as 6 plus p/e ratio)	-11.0% ***	-17.8% ***	-18.8% ***	-20.5% ***
Test 11 (separate slope coefficients)	-12.7% ***	-19.5% ***	-22.2% ***	-27.8% ***

\* Statistically significant at the 10% level in a two-tailed test.

\*\* Statistically significant at the 5% level in a two-tailed test.

\*\*\* Statistically significant at the 1% level in a two-tailed test.

Table 23  
Average Execution Rates for 500-1999 Share Marketable Limit Orders

	Size Category			
	Very Large	Large	Middle	Small
<b>Test 1 Closely Matched Pairs</b>				
Number of Pairs (54 total)	5	14	25	10
Average Across Nasdaq Stocks	69.6%	73.8%	82.6%	84.3%
Average Across NYSE Stocks	86.6%	88.3%	93.1%	93.5%
Difference	-17.1% **	-14.4% ***	-10.5% ***	-9.2%
<b>Test 2 All Matched Pairs</b>				
Number of Pairs (203 total)	25	33	68	77
Average Across Nasdaq Stocks	56.4%	69.4%	74.1%	76.3%
Average Across NYSE Stocks	84.0%	87.8%	92.2%	94.9%
Difference	-27.6% ***	-18.5% ***	-18.1% ***	-18.6% ***
<b>Other Tests of the Difference</b>				
Test 3 (203 pairs, regression)	-18.9% ***	-12.4% ***	-13.2% ***	-12.4% ***
Test 4 (same as 3 except 1-yr volatility)	-22.5% ***	-12.0% ***	-12.8% ***	-12.6% ***
Test 5 (same as 3 plus listing control)	-18.8% ***	-11.7% ***	-11.6% ***	-12.8% ***
Number of NYSE stocks in tests 6-10	33	490	330	68
Test 6 regression	-21.9% ***	-17.7% ***	-13.7% ***	-15.2% ***
Test 7 (same as 6 except 1-yr volatility)	-22.7% ***	-17.6% ***	-12.3% ***	-15.8% ***
Test 8 (same as 6 plus SIC code)	-19.3% ***	-17.2% ***	-14.5% ***	-16.0% ***
Test 9 (same as 6 plus listing control)	-21.9% ***	-17.8% ***	-13.2% ***	-15.5% ***
Test 10 (same as 6 plus p/e ratio)	-21.9% ***	-17.4% ***	-12.7% ***	-13.4% ***
Test 11 (separate slope coefficients)	-25.9% ***	-19.3% ***	-16.6% ***	-18.5% ***

\* Statistically significant at the 10% level in a two-tailed test.

\*\* Statistically significant at the 5% level in a two-tailed test.

\*\*\* Statistically significant at the 1% level in a two-tailed test.

Table 24  
Average Execution Rates for 2000-4999 Share Marketable Limit Orders

	Size Category			
	Very Large	Large	Middle	Small
<b>Test 1 Closely Matched Pairs</b>				
Number of Pairs (32 total)	5	12	13	2
Average Across Nasdaq Stocks	73.5%	71.0%	69.3%	81.1%
Average Across NYSE Stocks	86.1%	86.1%	87.9%	75.0%
Difference	-12.6% **	-15.1% ***	-18.6% ***	6.1%
<b>Test 2 All Matched Pairs</b>				
Number of Pairs (148 total)	25	30	50	43
Average Across Nasdaq Stocks	62.9%	63.8%	66.0%	73.8%
Average Across NYSE Stocks	83.5%	85.6%	89.7%	88.7%
Difference	-20.6% ***	-21.8% ***	-23.7% ***	-14.9% ***
<b>Other Tests of the Difference</b>				
Test 3 (148 pairs, regression)	-12.1% ***	-13.0% ***	-18.8% ***	-10.0%
Test 4 (same as 3 except 1-yr volatility)	-16.9% ***	-14.7% ***	-17.4% ***	-9.9%
Test 5 (same as 3 plus listing control)	-11.7% **	-12.8% ***	-17.4% ***	-13.1% **
Number of NYSE stocks in tests 6-10	33	479	254	48
Test 6 regression	-12.5% ***	-20.8% ***	-18.6% ***	-14.3% ***
Test 7 (same as 6 except 1-yr volatility)	-13.9% ***	-21.0% ***	-17.9% ***	-13.9% ***
Test 8 (same as 6 plus SIC code)	-11.4% ***	-19.9% ***	-16.7% ***	-15.3% ***
Test 9 (same as 6 plus listing control)	-12.4% ***	-20.9% ***	-17.2% ***	-15.2% ***
Test 10 (same as 6 plus p/e ratio)	-12.3% ***	-21.0% ***	-17.6% ***	-13.1% ***
Test 11 (separate slope coefficients)	-18.7% ***	-22.1% ***	-20.6% ***	-13.6% ***

\* Statistically significant at the 10% level in a two-tailed test.

\*\* Statistically significant at the 5% level in a two-tailed test.

\*\*\* Statistically significant at the 1% level in a two-tailed test.

Table 25  
Average Execution Rates for 100-499 Share Inside the Quote Limit Orders

	Size Category			
	Very Large	Large	Middle	Small
<b>Test 1 Closely Matched Pairs</b>				
Number of Pairs (52 total)	5	14	23	10
Average Across Nasdaq Stocks	27.3%	46.0%	45.2%	53.2%
Average Across NYSE Stocks	69.8%	66.7%	59.9%	71.6%
Difference	-42.5% ***	-20.7% ***	-14.7% ***	-18.3% *
<b>Test 2 All Matched Pairs</b>				
Number of Pairs (164 total)	25	33	66	50
Average Across Nasdaq Stocks	33.6%	44.6%	49.2%	51.7%
Average Across NYSE Stocks	67.0%	62.3%	66.3%	72.8%
Difference	-33.4% ***	-17.8% ***	-17.1% ***	-21.2% ***
<b>Other Tests of the Difference</b>				
Test 3 (164 pairs, regression)	-37.9% ***	-17.7% ***	-17.4% ***	-20.3% ***
Test 4 (same as 3 except 1-yr volatility)	-35.9% ***	-17.9% ***	-18.3% ***	-20.2% ***
Test 5 (same as 3 plus listing control)	-38.5% ***	-18.1% ***	-18.7% ***	-23.1% ***
Number of NYSE stocks in tests 6-10	33	489	332	47
Test 6 regression	-36.1% ***	-21.1% ***	-19.1% ***	-22.5% ***
Test 7 (same as 6 except 1-yr volatility)	-35.6% ***	-21.2% ***	-19.9% ***	-22.9% ***
Test 8 (same as 6 plus SIC code)	-33.0% ***	-20.0% ***	-21.4% ***	-27.4% ***
Test 9 (same as 6 plus listing control)	-35.9% ***	-22.7% ***	-19.6% ***	-24.6% ***
Test 10 (same as 6 plus p/e ratio)	-36.3% ***	-20.6% ***	-20.1% ***	-22.2% ***
Test 11 (separate slope coefficients)	-29.7% ***	-20.6% ***	-18.2% ***	-26.2% ***

\* Statistically significant at the 10% level in a two-tailed test.

\*\* Statistically significant at the 5% level in a two-tailed test.

\*\*\* Statistically significant at the 1% level in a two-tailed test.

Table 26  
Average Execution Rates for 500-1999 Share Inside the Quote Limit Orders

	Size Category			
	Very Large	Large	Middle	Small
<b>Test 1 Closely Matched Pairs</b>				
Number of Pairs (53 total)	5	14	23	11
Average Across Nasdaq Stocks	17.2%	42.0%	40.5%	47.1%
Average Across NYSE Stocks	69.5%	62.7%	55.4%	63.2%
Difference	-52.3% ***	-20.7% ***	-14.9% ***	-16.1% *
<b>Test 2 All Matched Pairs</b>				
Number of Pairs (192 total)	25	33	65	69
Average Across Nasdaq Stocks	22.5%	39.2%	43.3%	49.8%
Average Across NYSE Stocks	68.0%	61.0%	62.2%	65.3%
Difference	-45.4% ***	-21.8% ***	-18.9% ***	-15.5% ***
<b>Other Tests of the Difference</b>				
Test 3 (192 pairs, regression)	-47.5% ***	-14.9% ***	-15.2% ***	-13.5% ***
Test 4 (same as 3 except 1-yr volatility)	-46.8% ***	-16.3% ***	-13.7% ***	-13.2% ***
Test 5 (same as 3 plus listing control)	-47.8% ***	-15.0% ***	-16.2% ***	-15.6% ***
Number of NYSE stocks in tests 6-10	33	489	335	67
Test 6 regression	-46.3% ***	-19.9% ***	-18.1% ***	-10.9% ***
Test 7 (same as 6 except 1-yr volatility)	-46.2% ***	-20.7% ***	-16.8% ***	-11.1% ***
Test 8 (same as 6 plus SIC code)	-42.7% ***	-20.0% ***	-17.8% ***	-13.0% ***
Test 9 (same as 6 plus listing control)	-46.2% ***	-20.2% ***	-18.8% ***	-12.2% ***
Test 10 (same as 6 plus p/e ratio)	-46.4% ***	-20.0% ***	-18.3% ***	-10.1% ***
Test 11 (separate slope coefficients)	-42.6% ***	-20.1% ***	-19.2% ***	-13.9% ***

\* Statistically significant at the 10% level in a two-tailed test.

\*\* Statistically significant at the 5% level in a two-tailed test.

\*\*\* Statistically significant at the 1% level in a two-tailed test.

Table 27  
Average Execution Rates for 2000-4999 Share Inside the Quote Limit Orders

	Size Category			
	Very Large	Large	Middle	Small
<b>Test 1 Closely Matched Pairs</b>				
Number of Pairs (33 total)	5	12	13	3
Average Across Nasdaq Stocks	22.7%	41.7%	40.6%	17.7%
Average Across NYSE Stocks	78.8%	61.4%	64.5%	62.8%
Difference	-56.2% ***	-19.7% **	-23.9% ***	-45.1% ***
<b>Test 2 All Matched Pairs</b>				
Number of Pairs (142 total)	25	30	51	36
Average Across Nasdaq Stocks	29.5%	40.1%	37.5%	49.7%
Average Across NYSE Stocks	73.3%	61.5%	66.3%	68.4%
Difference	-43.8% ***	-21.4% ***	-28.7% ***	-18.7% ***
<b>Other Tests of the Difference</b>				
Test 3 (142 pairs, regression)	-45.6% ***	-16.7% ***	-26.9% ***	-33.2% ***
Test 4 (same as 3 except 1-yr volatility)	-46.5% ***	-16.6% ***	-25.5% ***	-34.8% ***
Test 5 (same as 3 plus listing control)	-46.3% ***	-16.7% ***	-29.7% ***	-31.9% ***
Number of NYSE stocks in tests 6-10	33	471	256	46
Test 6 regression	-40.6% ***	-23.8% ***	-25.9% ***	-22.6% ***
Test 7 (same as 6 except 1-yr volatility)	-41.2% ***	-23.6% ***	-23.7% ***	-23.7% ***
Test 8 (same as 6 plus SIC code)	-36.6% ***	-23.0% ***	-22.7% ***	-24.0% ***
Test 9 (same as 6 plus listing control)	-40.7% ***	-23.8% ***	-25.1% ***	-23.9% ***
Test 10 (same as 6 plus p/e ratio)	-40.6% ***	-23.6% ***	-25.6% ***	-24.8% ***
Test 11 (separate slope coefficients)	-42.2% ***	-22.8% ***	-30.0% ***	-17.3% **

\* Statistically significant at the 10% level in a two-tailed test.

\*\* Statistically significant at the 5% level in a two-tailed test.

\*\*\* Statistically significant at the 1% level in a two-tailed test.

Table 28  
Average Execution Rates for 100-499 Share at the Quote Limit Orders

	Size Category			
	Very Large	Large	Middle	Small
<b>Test 1 Closely Matched Pairs</b>				
Number of Pairs (53 total)	5	14	26	8
Average Across Nasdaq Stocks	41.3%	33.1%	29.7%	38.9%
Average Across NYSE Stocks	47.7%	35.1%	37.9%	42.3%
Difference	-6.4% *	-2.1%	-8.3%	-3.4%
<b>Test 2 All Matched Pairs</b>				
Number of Pairs (184 total)	25	33	70	56
Average Across Nasdaq Stocks	40.5%	34.1%	38.2%	44.3%
Average Across NYSE Stocks	47.1%	34.3%	40.0%	44.8%
Difference	-6.6% ***	-0.2%	-1.8%	-0.4%
<b>Other Tests of the Difference</b>				
Test 3 (184 pairs, regression)	-6.6% ***	0.3%	-7.5% *	-3.4%
Test 4 (same as 3 except 1-yr volatility)	-7.1% ***	0.1%	-6.6% *	-3.8%
Test 5 (same as 3 plus listing control)	-7.6% ***	0.1%	-11.2% ***	-2.4%
Number of NYSE stocks in tests 6-10	33	490	335	66
Test 6 regression	-9.7% ***	-4.8% **	-2.6%	-6.9% *
Test 7 (same as 6 except 1-yr volatility)	-9.9% ***	-4.6% **	-2.8%	-7.2% *
Test 8 (same as 6 plus SIC code)	-8.5% ***	-3.8% *	-4.7% **	-7.3%
Test 9 (same as 6 plus listing control)	-9.6% ***	-4.9% **	-3.0%	-6.7%
Test 10 (same as 6 plus p/e ratio)	-9.9% ***	-4.7% **	-3.2%	-7.4% *
Test 11 (separate slope coefficients)	-5.6% **	-4.2% **	-2.2%	-6.3%

\* Statistically significant at the 10% level in a two-tailed test.

\*\* Statistically significant at the 5% level in a two-tailed test.

\*\*\* Statistically significant at the 1% level in a two-tailed test.

Table 29  
Average Execution Rates for 500-1999 Share at the Quote Limit Orders

	Size Category			
	Very Large	Large	Middle	Small
<b>Test 1 Closely Matched Pairs</b>				
Number of Pairs (53 total)	5	14	26	8
Average Across Nasdaq Stocks	29.7%	35.9%	31.0%	34.8%
Average Across NYSE Stocks	48.3%	35.9%	33.8%	45.8%
Difference	-18.6% **	0.0%	-2.8%	-11.1%
<b>Test 2 All Matched Pairs</b>				
Number of Pairs (194 total)	25	33	68	68
Average Across Nasdaq Stocks	33.7%	35.6%	37.3%	37.9%
Average Across NYSE Stocks	48.1%	37.8%	39.0%	44.6%
Difference	-14.4% ***	-2.2%	-1.7%	-6.7% ***
<b>Other Tests of the Difference</b>				
Test 3 (194 pairs, regression)	-10.8% **	2.4%	-3.7%	-10.0% **
Test 4 (same as 3 except 1-yr volatility)	-11.3% ***	3.3%	-2.5%	-10.0% ***
Test 5 (same as 3 plus listing control)	-12.7% ***	3.6%	-4.7%	-9.9% ***
Number of NYSE stocks in tests 6-10	33	489	334	66
Test 6 regression	-15.9% ***	-3.5%	-4.0% *	-10.5% ***
Test 7 (same as 6 except 1-yr volatility)	-15.7% ***	-3.8%	-3.5%	-10.5% ***
Test 8 (same as 6 plus SIC code)	-14.6% ***	-3.1%	-5.4% **	-8.9% **
Test 9 (same as 6 plus listing control)	-16.1% ***	-3.2%	-5.1% **	-11.3% ***
Test 10 (same as 6 plus p/e ratio)	-16.3% ***	-4.0%	-3.9%	-10.6% ***
Test 11 (separate slope coefficients)	-11.9% ***	-5.1% **	-4.8% *	-11.5% **

\* Statistically significant at the 10% level in a two-tailed test.

\*\* Statistically significant at the 5% level in a two-tailed test.

\*\*\* Statistically significant at the 1% level in a two-tailed test.

Table 30  
Average Execution Rates for 2000-4999 Share at the Quote Limit Orders

	Size Category			
	Very Large	Large	Middle	Small
<b>Test 1 Closely Matched Pairs</b>				
Number of Pairs (36 total)	5	13	16	2
Average Across Nasdaq Stocks	50.8%	40.3%	34.9%	26.8%
Average Across NYSE Stocks	57.3%	47.5%	44.1%	34.3%
Difference	-6.6%	-7.2%	-9.2%	-7.4%
<b>Test 2 All Matched Pairs</b>				
Number of Pairs (143 total)	25	31	53	34
Average Across Nasdaq Stocks	46.0%	41.7%	37.7%	36.2%
Average Across NYSE Stocks	60.2%	49.5%	50.6%	47.9%
Difference	-14.2% ***	-7.8% **	-13.0% ***	-11.7% ***
<b>Other Tests of the Difference</b>				
Test 3 (143 pairs, regression)	-8.3%	-1.1%	-17.0% ***	-12.5% *
Test 4 (same as 3 except 1-yr volatility)	-12.7% **	0.0%	-16.3% ***	-12.6% *
Test 5 (same as 3 plus listing control)	-8.0%	-0.7%	-19.3% ***	-11.5%
Number of NYSE stocks in tests 6-10	33	477	271	51
Test 6 regression	-11.1% ***	-11.4% ***	-12.5% ***	-20.6% ***
Test 7 (same as 6 except 1-yr volatility)	-12.3% ***	-10.8% ***	-13.1% ***	-20.9% ***
Test 8 (same as 6 plus SIC code)	-9.5% ***	-11.1% ***	-11.3% ***	-23.4% ***
Test 9 (same as 6 plus listing control)	-11.1% ***	-10.3% ***	-12.1% ***	-20.6% ***
Test 10 (same as 6 plus p/e ratio)	-11.2% ***	-11.6% ***	-12.1% ***	-22.2% ***
Test 11 (separate slope coefficients)	-13.4% ***	-13.9% ***	-13.9% ***	-10.7% *

\* Statistically significant at the 10% level in a two-tailed test.

\*\* Statistically significant at the 5% level in a two-tailed test.

\*\*\* Statistically significant at the 1% level in a two-tailed test.

Table 31  
Weekly-to-Daily Variance Ratios

	Size Category			
	Very Large	Large	Middle	Small
<b>Test 1 Closest Matched Pairs</b>				
Number of Pairs (58 total)	5	14	26	13
Average Across Nasdaq Stocks	0.940	0.834	0.790	0.854
Average Across NYSE Stocks	0.956	0.968	0.996	1.034
Difference	-0.016	-0.135 **	-0.206 ***	-0.180 **
<b>Test 2 All Matched Pairs</b>				
Number of Pairs (221 total)	25	33	72	91
Average Across Nasdaq Stocks	0.979	0.935	0.859	0.821
Average Across NYSE Stocks	0.963	0.980	1.006	1.032
Difference	0.016	-0.045	-0.147 ***	-0.210 ***
<b>Other Tests of the Difference</b>				
Test 3 (221 pairs, regression)	-0.053	-0.085 *	-0.159 ***	-0.219 ***
Test 4 (same as 3 except 1-yr volatility)	-0.006	-0.062	-0.151 ***	-0.218 ***
Test 5 (same as 3 plus listing control)	-0.052	-0.072	-0.155 ***	-0.219 ***
Number of NYSE stocks in tests 6-10	33	490	340	77
Test 6 regression	-0.029	-0.119 ***	-0.223 ***	-0.140 ***
Test 7 (same as 6 except 1-yr volatility)	-0.004	-0.095 ***	-0.212 ***	-0.143 ***
Test 8 (same as 6 plus SIC code)	0.025	-0.112 ***	-0.192 ***	-0.164 ***
Test 9 (same as 6 plus listing control)	-0.029	-0.104 ***	-0.219 ***	-0.153 ***
Test 10 (same as 6 plus p/e ratio)	-0.029	-0.116 ***	-0.208 ***	-0.121 ***
Test 11 (separate slope coefficients)	-0.049	-0.129 ***	-0.283 ***	-0.242 ***

\* Statistically significant at the 10% level in a two-tailed test.

\*\* Statistically significant at the 5% level in a two-tailed test.

\*\*\* Statistically significant at the 1% level in a two-tailed test.

Table 32  
Four-Week-to-Daily Variance Ratios

	Size Category			
	Very Large	Large	Middle	Small
<b>Test 1 Closest Matched Pairs</b>				
Number of Pairs (58 total)	5	14	26	13
Average Across Nasdaq Stocks	0.832	0.671	0.636	0.680
Average Across NYSE Stocks	0.874	1.032	0.917	0.946
Difference	-0.042	-0.361 ***	-0.281 ***	-0.266 ***
<b>Test 2 All Matched Pairs</b>				
Number of Pairs (221 total)	25	33	72	91
Average Across Nasdaq Stocks	0.873	0.833	0.752	0.698
Average Across NYSE Stocks	0.882	0.990	0.981	0.919
Difference	-0.009	-0.157 **	-0.229 ***	-0.221 ***
<b>Other Tests of the Difference</b>				
Test 3 (221 pairs, regression)	-0.090	-0.244 ***	-0.221 ***	-0.232 ***
Test 4 (same as 3 except 1-yr volatility)	-0.034	-0.237 ***	-0.209 ***	-0.223 ***
Test 5 (same as 3 plus listing control)	-0.109	-0.237 ***	-0.204 ***	-0.224 ***
Number of NYSE stocks in tests 6-10	33	490	340	77
Test 6 regression	-0.038	-0.194 ***	-0.258 ***	-0.167 ***
Test 7 (same as 6 except 1-yr volatility)	-0.010	-0.175 ***	-0.248 ***	-0.164 ***
Test 8 (same as 6 plus SIC code)	0.081	-0.208 ***	-0.226 ***	-0.182 ***
Test 9 (same as 6 plus listing control)	-0.038	-0.189 ***	-0.251 ***	-0.173 ***
Test 10 (same as 6 plus p/e ratio)	-0.037	-0.196 ***	-0.262 ***	-0.142 ***
Test 11 (separate slope coefficients)	-0.116	-0.194 ***	-0.322 ***	-0.205 *

\* Statistically significant at the 10% level in a two-tailed test.

\*\* Statistically significant at the 5% level in a two-tailed test.

\*\*\* Statistically significant at the 1% level in a two-tailed test.

Table 33  
Four-Week-to-One-Week Variance Ratios

	Size Category			
	Very Large	Large	Middle	Small
<b>Test 1 Closest Matched Pairs</b>				
Number of Pairs (58 total)	5	14	26	13
Average Across Nasdaq Stocks	0.871	0.790	0.793	0.785
Average Across NYSE Stocks	0.912	1.049	0.901	0.903
Difference	-0.041	-0.260 ***	-0.108	-0.118 *
<b>Test 2 All Matched Pairs</b>				
Number of Pairs (221 total)	25	33	72	91
Average Across Nasdaq Stocks	0.887	0.882	0.861	0.845
Average Across NYSE Stocks	0.915	0.999	0.969	0.887
Difference	-0.028	-0.117 **	-0.108 ***	-0.041
<b>Other Tests of the Difference</b>				
Test 3 (221 pairs, regression)	-0.045	-0.190 ***	-0.089 *	-0.056
Test 4 (same as 3 except 1-yr volatility)	-0.022	-0.202 ***	-0.086 *	-0.047
Test 5 (same as 3 plus listing control)	-0.069	-0.193 ***	-0.081 *	-0.045
Number of NYSE stocks in tests 6-10	33	490	340	77
Test 6 regression	-0.021	-0.098 **	-0.074 **	-0.046
Test 7 (same as 6 except 1-yr volatility)	-0.010	-0.103 **	-0.073 *	-0.036
Test 8 (same as 6 plus SIC code)	0.052	-0.123 **	-0.061	-0.036
Test 9 (same as 6 plus listing control)	-0.021	-0.109 **	-0.073 *	-0.036
Test 10 (same as 6 plus p/e ratio)	-0.021	-0.106 **	-0.092 **	-0.037
Test 11 (separate slope coefficients)	-0.084	-0.083 *	-0.082 **	0.001

\* Statistically significant at the 10% level in a two-tailed test.

\*\* Statistically significant at the 5% level in a two-tailed test.

\*\*\* Statistically significant at the 1% level in a two-tailed test.

Table 34  
Adjusted<sup>†</sup> Weekly-to-Daily Variance Ratios

	Size Category			
	Very Large	Large	Middle	Small
<b>Test 1 Closest Matched Pairs</b>				
Number of Pairs (58 total)	5	14	26	13
Average Across Nasdaq Stocks	0.941	0.875	0.880	0.965
Average Across NYSE Stocks	0.957	0.978	1.033	1.097
Difference	-0.016	-0.102	-0.153 ***	-0.132
<b>Test 2 All Matched Pairs</b>				
Number of Pairs (221 total)	25	33	72	91
Average Across Nasdaq Stocks	0.980	0.958	0.912	0.929
Average Across NYSE Stocks	0.964	0.985	1.029	1.095
Difference	0.016	-0.027	-0.117 ***	-0.167 ***
<u>Other Tests of the Difference</u>				
Test 3 (221 pairs, regression)	-0.054	-0.060	-0.125 ***	-0.165 ***
Test 4 (same as 3 except 1-yr volatility)	-0.006	-0.040	-0.116 ***	-0.167 ***
Test 5 (same as 3 plus listing control)	-0.053	-0.046	-0.116 ***	-0.182 ***
Number of NYSE stocks in tests 6-10	33	490	340	77
Test 6 regression	-0.029	-0.093 ***	-0.173 ***	-0.111 ***
Test 7 (same as 6 except 1-yr volatility)	-0.005	-0.071 ***	-0.163 ***	-0.124 ***
Test 8 (same as 6 plus SIC code)	0.024	-0.088 ***	-0.144 ***	-0.132 ***
Test 9 (same as 6 plus listing control)	-0.029	-0.077 ***	-0.165 ***	-0.125 ***
Test 10 (same as 6 plus p/e ratio)	-0.029	-0.089 ***	-0.155 ***	-0.095 ***
Test 11 (separate slope coefficients)	-0.049	-0.105 ***	-0.237 ***	-0.192 ***

<sup>†</sup> eliminating the impact of market order effective spreads

\* Statistically significant at the 10% level in a two-tailed test.

\*\* Statistically significant at the 5% level in a two-tailed test.

\*\*\* Statistically significant at the 1% level in a two-tailed test.

Table 35  
Adjusted<sup>†</sup> Four-Week-to-Daily Variance Ratios

	Size Category			
	Very Large	Large	Middle	Small
<b>Test 1 Closest Matched Pairs</b>				
Number of Pairs (58 total)	5	14	26	13
Average Across Nasdaq Stocks	0.834	0.743	0.774	0.837
Average Across NYSE Stocks	0.876	1.043	0.971	1.031
Difference	-0.041	-0.300 ***	-0.197 ***	-0.194 **
<b>Test 2 All Matched Pairs</b>				
Number of Pairs (221 total)	25	33	72	91
Average Across Nasdaq Stocks	0.874	0.870	0.829	0.844
Average Across NYSE Stocks	0.884	0.997	1.013	1.004
Difference	-0.010	-0.127 **	-0.184 ***	-0.161 ***
<b>Other Tests of the Difference</b>				
Test 3 (221 pairs, regression)	-0.091	-0.195 ***	-0.164 ***	-0.157 ***
Test 4 (same as 3 except 1-yr volatility)	-0.034	-0.192 ***	-0.152 ***	-0.153 ***
Test 5 (same as 3 plus listing control)	-0.110	-0.187 ***	-0.139 ***	-0.172 ***
Number of NYSE stocks in tests 6-10	33	490	340	77
Test 6 regression	-0.039	-0.151 ***	-0.184 ***	-0.124 ***
Test 7 (same as 6 except 1-yr volatility)	-0.011	-0.136 ***	-0.174 ***	-0.135 ***
Test 8 (same as 6 plus SIC code)	0.080	-0.166 ***	-0.157 ***	-0.132 **
Test 9 (same as 6 plus listing control)	-0.039	-0.145 ***	-0.171 ***	-0.134 ***
Test 10 (same as 6 plus p/e ratio)	-0.038	-0.153 ***	-0.183 ***	-0.104 **
Test 11 (separate slope coefficients)	-0.116	-0.157 ***	-0.255 ***	-0.144 *

<sup>†</sup> eliminating the impact of market order effective spreads

\* Statistically significant at the 10% level in a two-tailed test.

\*\* Statistically significant at the 5% level in a two-tailed test.

\*\*\* Statistically significant at the 1% level in a two-tailed test.

Table 36  
Adjusted<sup>†</sup> Four-Week-to-One-Week Variance Ratios

	Size Category			
	Very Large	Large	Middle	Small
<b>Test 1 Closest Matched Pairs</b>				
Number of Pairs (58 total)	5	14	26	13
Average Across Nasdaq Stocks	0.872	0.814	0.822	0.817
Average Across NYSE Stocks	0.913	1.051	0.911	0.919
Difference	-0.041	-0.237 ***	-0.089	-0.102 *
<b>Test 2 All Matched Pairs</b>				
Number of Pairs (221 total)	25	33	72	91
Average Across Nasdaq Stocks	0.887	0.893	0.877	0.877
Average Across NYSE Stocks	0.915	1.000	0.975	0.904
Difference	-0.028	-0.107 **	-0.098 **	-0.027
<u>Other Tests of the Difference</u>				
Test 3 (221 pairs, regression)	-0.045	-0.171 ***	-0.077 *	-0.037
Test 4 (same as 3 except 1-yr volatility)	-0.022	-0.185 ***	-0.074 *	-0.029
Test 5 (same as 3 plus listing control)	-0.069	-0.174 ***	-0.066 *	-0.032
Number of NYSE stocks in tests 6-10	33	490	340	77
Test 6 regression	-0.021	-0.084 **	-0.058 **	-0.033
Test 7 (same as 6 except 1-yr volatility)	-0.010	-0.089 **	-0.057 *	-0.027
Test 8 (same as 6 plus SIC code)	0.052	-0.109 **	-0.045	-0.022
Test 9 (same as 6 plus listing control)	-0.021	-0.094 **	-0.056 *	-0.023
Test 10 (same as 6 plus p/e ratio)	-0.021	-0.091 **	-0.074 **	-0.025
Test 11 (separate slope coefficients)	-0.084	-0.072 *	-0.067 **	0.015

<sup>†</sup> eliminating the impact of market order effective spreads

\* Statistically significant at the 10% level in a two-tailed test.

\*\* Statistically significant at the 5% level in a two-tailed test.

\*\*\* Statistically significant at the 1% level in a two-tailed test.

Appendix A: Academic Literature Review

Comparisons of the Same Stock Across Different Markets

Study	Sample Period	Findings
Ying, Lewellen, Schlarbaum and Lease 1977 JFQA	1970's	Positive price reactions result when firms announce their intent to list on the NYSE (from OTC market).
Sanger and McConnell 1986 JFQA	1970's-80's	Positive price reactions to announcement of OTC to NYSE moves, during post-announcement pre-listing period and post-listing period. When Nasdaq implemented, only listing returns remain positive.
Grammatikos and Papaioannou 1986 JFR	1975-81	For 88 non-financial firms switching from Nasdaq to NYSE or Amex, the positive price reaction to the announcement is isolated in low liquidity Nasdaq firms only.
Baker and Edelman 1991 QJBE	1982-87	For 62 stocks that switch from Nasdaq to Amex, low liquidity stocks exhibit positive price reactions to the announcement while higher liquidity stocks do not.
Lee 1993 JF	1988-89	For NYSE listed securities, price executions at the Cincinnati, Midwest, and New York stock exchanges are most favorable to trade initiators, with NASD executions the least favorable. The difference is largest for the smallest trades. The author questions the adequacy of the existing ITS, the broker's responsibility for 'best execution,' and the propriety of order flow inducements.
Kadlec and McConnell 1994 JF	1980's	For Nasdaq to NYSE movers, positive announcement returns and prelisting returns. Consistent with both liquidity benefits as well as improved investor recognition.
Christie and Huang 1994 JFI	1990	For firms that moved from Nasdaq to the NYSE (and Amex), trading costs fell by 4.7 (5.2) cents per share. For NYSE stocks, the trading cost reductions are equally divided between quote improvements and the routing of trades to the NYSE. Trading cost improvements vary inversely with trade sizes and positively with dollar spreads and the greatest liquidity benefits from listing accrue to the less liquid stocks.

Barclay 1997 JFE	1983-92	For 472 Nasdaq stocks that move to the Amex or NYSE, effective and quoted spreads fall and the magnitude of the drop is related to the avoidance of odd eighths in dealer markets.
Clyde, Schultz and Zaman 1997 JF	1992-95	For 47 Amex stocks that move to the Nasdaq, effective and quoted spreads increase by 100%, with a puzzling positive reaction to the announced switch.
Bessembinder 1999 JFQA	1996-97	For 190 firms moving from Nasdaq to NYSE, spreads and volatility decline, with firms subject to new Nasdaq order handling rules experiencing less dramatic changes.
Heidle and Huang 1999 Working Paper	1996	For 122 stocks that switch among NYSE, Amex and Nasdaq, effective and quoted spreads are found to be larger in dealer markets. Dealer markets are more anonymous with a 35% higher probability of trading against informed traders.
Huang and Stoll 1999 Working Paper	1995	19 British stocks traded as ADRs on the NYSE have higher spreads but greater depth in the London dealer market.
Jones and Lipson 1999 Working Paper	1993-95	Examining 291 firms that move from Nasdaq to NYSE or Amex, they find it takes an hour for Nasdaq prices to fully adjust to trading activity. They suggest studies which rely on price changes to infer trading cost components should account for Nasdaq's partial price adjustments. In contrast to prior research, they find larger adverse selection costs on Nasdaq vs. the NYSE.
Jones and Lipson 1999 Working Paper	1993-95	Comparing institutional execution costs for 148 Nasdaq-NYSE and 64 Amex-NYSE movers, they find execution costs including commissions are indistinguishable across exchanges. They also find momentum trading and "working" of orders is greater on the NYSE. Suggests that institutions actively manage execution strategies, taking into account the market characteristics where they trade.

Comparisons of Matched Stocks across Different Markets

Study	Sample Period	Findings
Hasbrouck and Schwab 1986 Amex Report	1980's	Nasdaq spreads are larger than Amex.
Marsh and Rock 1986 Amex Report	1980's	Nasdaq spreads are larger than Amex.
Chan and Lakonishok 1995 JF	1986-88	Compared 37 institutional investors' execution costs (market impact plus commission) on the NYSE and Nasdaq controlling for firm size, trade size, and the money management firm's identity. Costs are lower on Nasdaq for trades in smaller firms, while costs are lower on NYSE for trading larger stocks. The cost differences are sensitive to the time period.
Huang and Stoll 1996 JFE	1991	Matched 175 NYSE and Nasdaq stocks on price, shares outstanding, long-term debt, SIC, and book value. Nasdaq quoted, effective, realized and implied spreads are about twice as large likely from internalization/preferencing and alternative interdealer systems that limit Nasdaq quote competition.
Booth, Iverson and Sarkar 1996 Working Paper	1990's?	Sample of Nasdaq stocks compared to German stocks. In general, the agency/auction market in Germany results in lower spreads than the Nasdaq dealer market.
Keim and Madhavan 1996 RFS	1985-92	For 5625 block trades negotiated "upstairs" for NYSE or across Nasdaq, found significantly larger temporary price effects on Nasdaq suggesting liquidity may be larger on NYSE.
Keim and Madhavan 1997 JFE	1991-93	21 institutions' trades show lower costs on NYSE than comparable trades on Nasdaq. The difference may result from market structures or from differences in trader or dealer behaviors.
LaPlante and Muscarella 1997 JFE	1990	Block trades for the largest Nasdaq stocks appear to be more expensive than similar block trades on the NYSE as measured by both temporary and permanent price effects.
Bessembinder and Kaufman 1997 JFE	1994	For trades completed on the NYSE, the NASD dealer market, and the regional exchanges, effective spreads are only slightly smaller on the NYSE. However, realized bid-ask spreads are lower on the NYSE by a factor of two to three. The differential is attributable to the successful 'cream skimming' of uninformed trades by off-NYSE marketmakers. The findings reinforce existing concerns about whether orders are routed so as to receive "best execution".

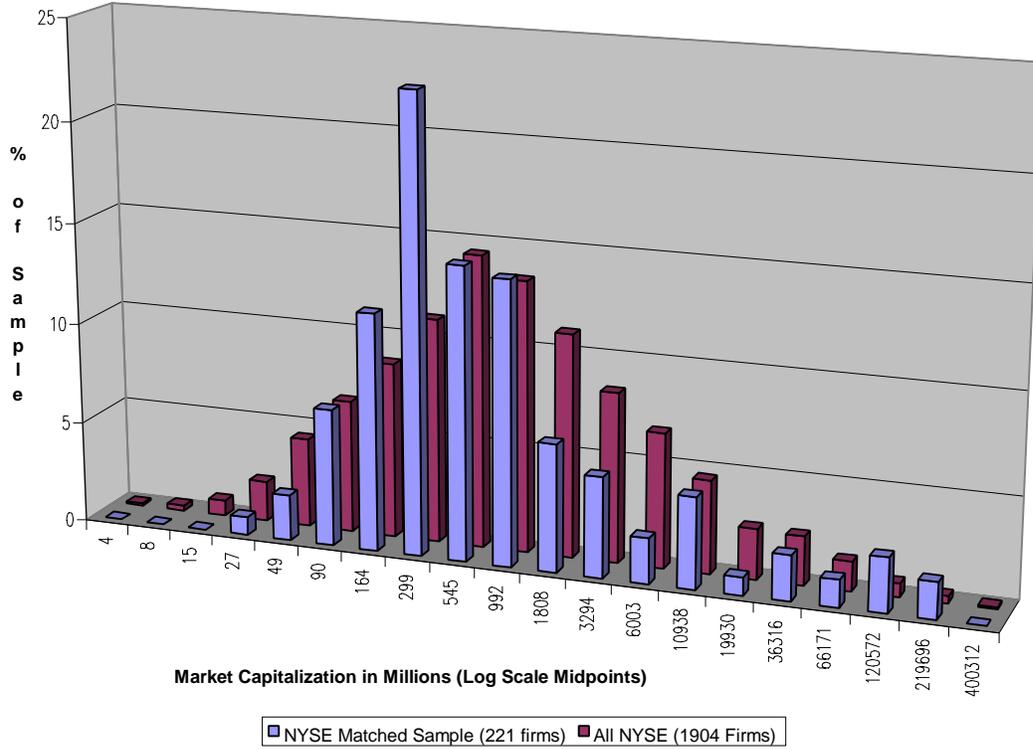
Bessembinder and Kaufman 1997 JFQA	1994	The average trade execution costs for sets of large, medium, and small capitalization stocks listed on the NYSE and Nasdaq. All cost measures, including quoted spreads, effective spreads and realized spreads are larger for Nasdaq stocks. The differences are greater for medium and small capitalization issues and for small trades. These differentials cannot be attributed to the adverse selection costs of market making.
Bessembinder 1999 JFQA	1997	Matched 539 Nasdaq and NYSE stocks on market capitalization and found smaller differences in trade execution costs across markets post-order handling rules, attributing the persistence to Nasdaq preferencing agreements.
Venkataraman 1999 Working Paper	1997-98	Compares the Paris pure limit order market with the NYSE and finds that the NYSE has lower transaction costs after controlling for size and price.
Christie, Harris and Kandel 1999 Working Paper	1997	Compares matched sample (based on market capitalization and price) of NYSE and Nasdaq firms and finds lower effective and quoted spreads on the NYSE for mid-sized and smaller firms. The 25 most active Nasdaq stocks subject to new order handling rules and trading in 1/16 <sup>th</sup> markets show no difference.
Weston Dec. 2000 JF	1996-97	Examines effects of the order handling rules on 88 Nasdaq stocks and concludes the decline in bid-ask spreads reduced dealers' rents. Matches the Nasdaq stocks to NYSE stocks and finds that differences in their spreads was greatly reduced after the OHR. Small differences in spreads remain.

#### Synopsis of Control Variables

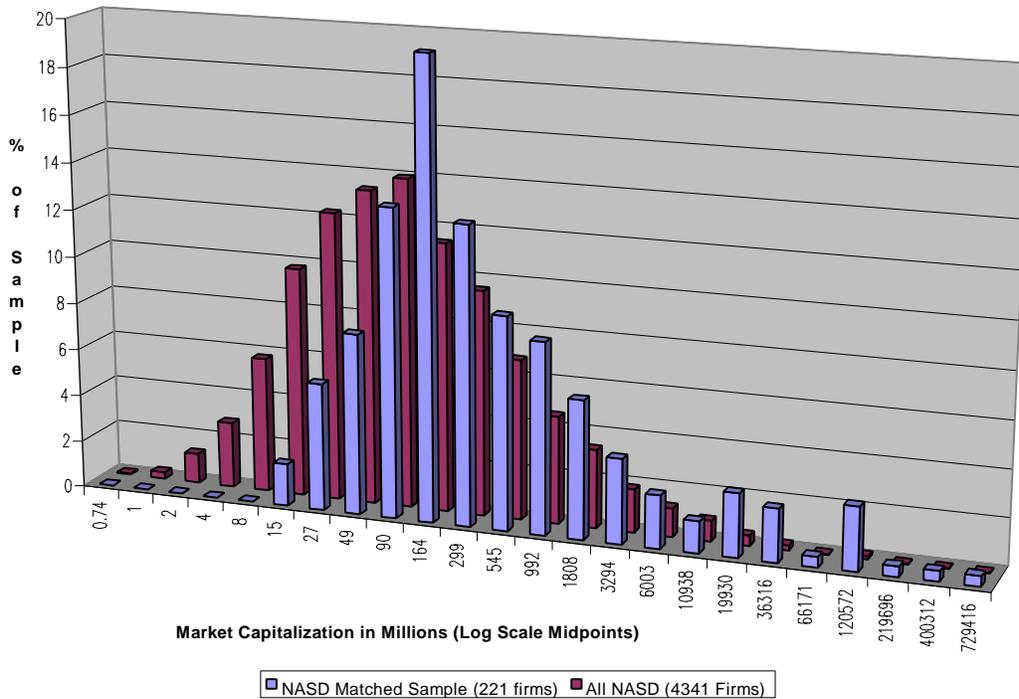
Most studies cited above control in one way or another for security characteristics. One of the most comprehensive set of controls is contained in Huang and Stoll (1996), who control for: price, shares outstanding, long-term debt, SIC code, and book value. Weston (2000) uses combinations of price, market capitalization, volatility, volume, trade size, and SIC codes to construct the three matched samples. The most common matching criterion is market capitalization, which is both readily available in the CRSP database and highly correlated with size, price and trading activity measures.

Appendix B: Graphical Comparison of NYSE and NASDAQ Stocks

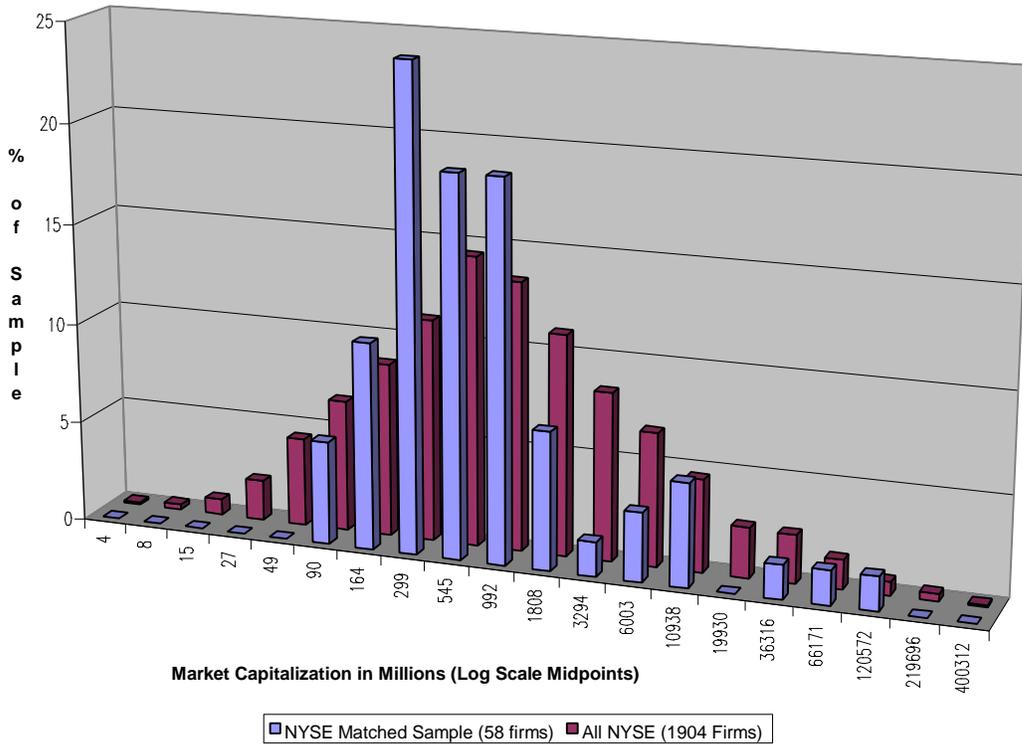
**Histogram of Market Capitalization for the NYSE**



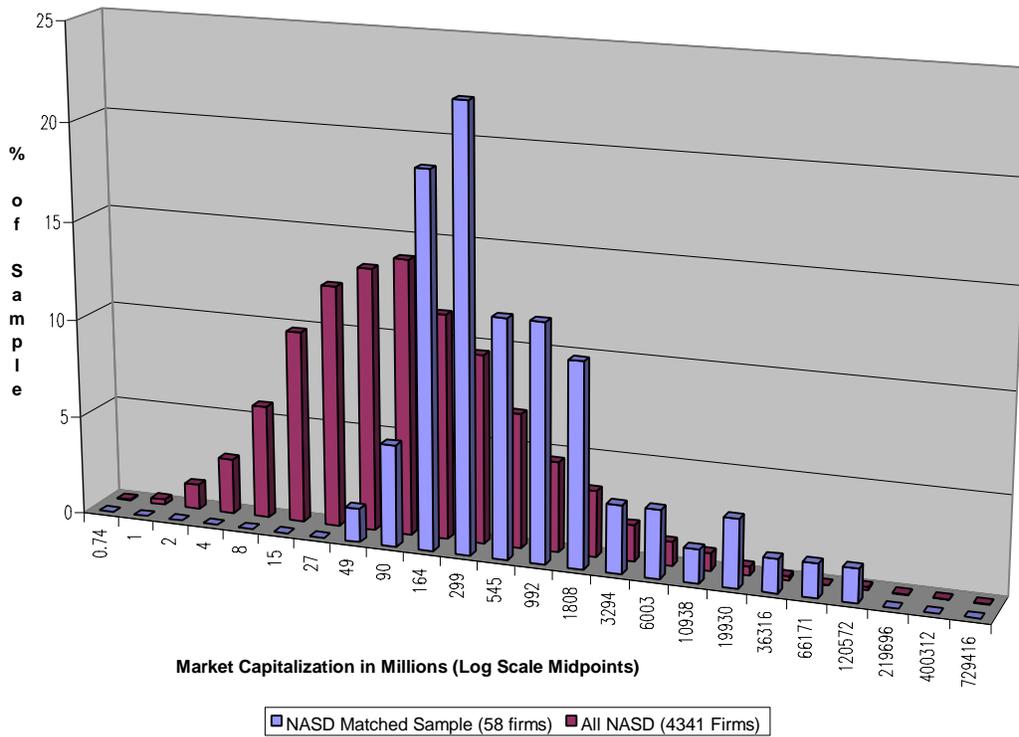
**Histogram of Market Capitalization for the NASD**



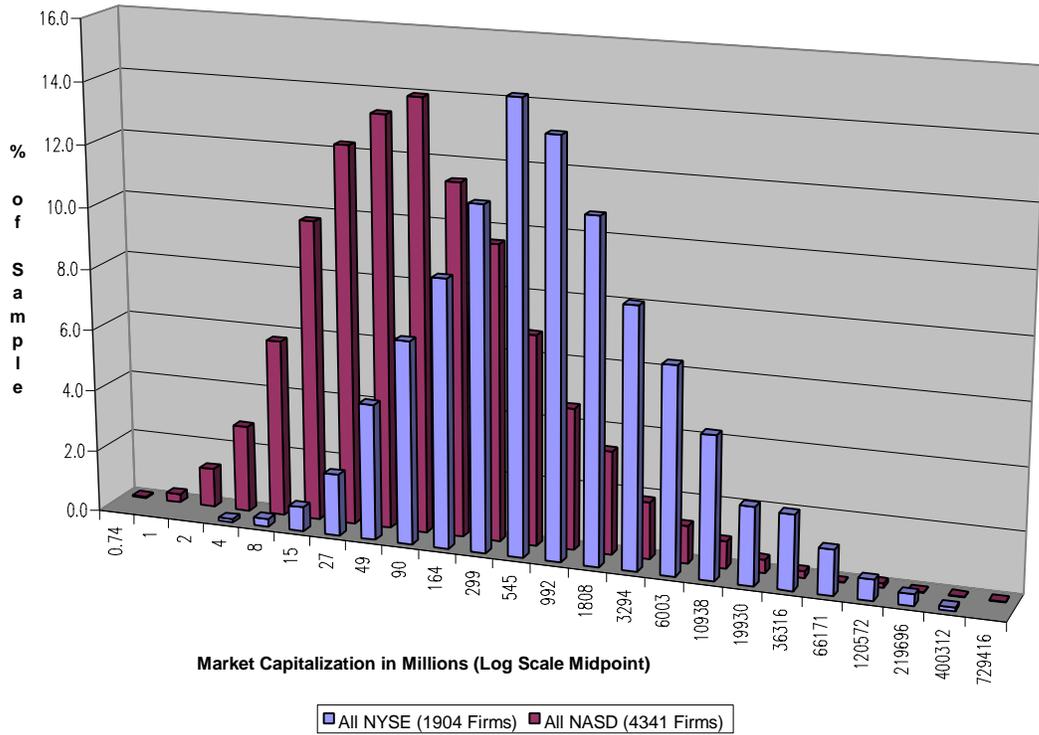
**Histogram of Market Capitalization for the NYSE**



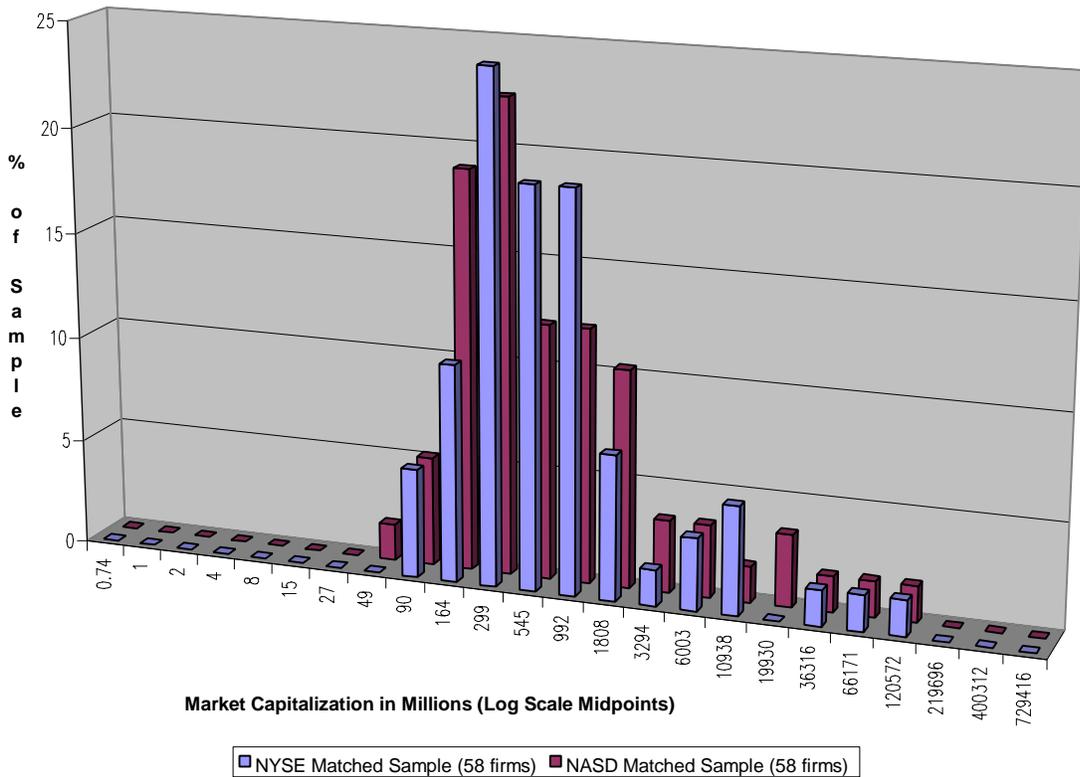
**Histogram of Market Capitalization for the NASD**



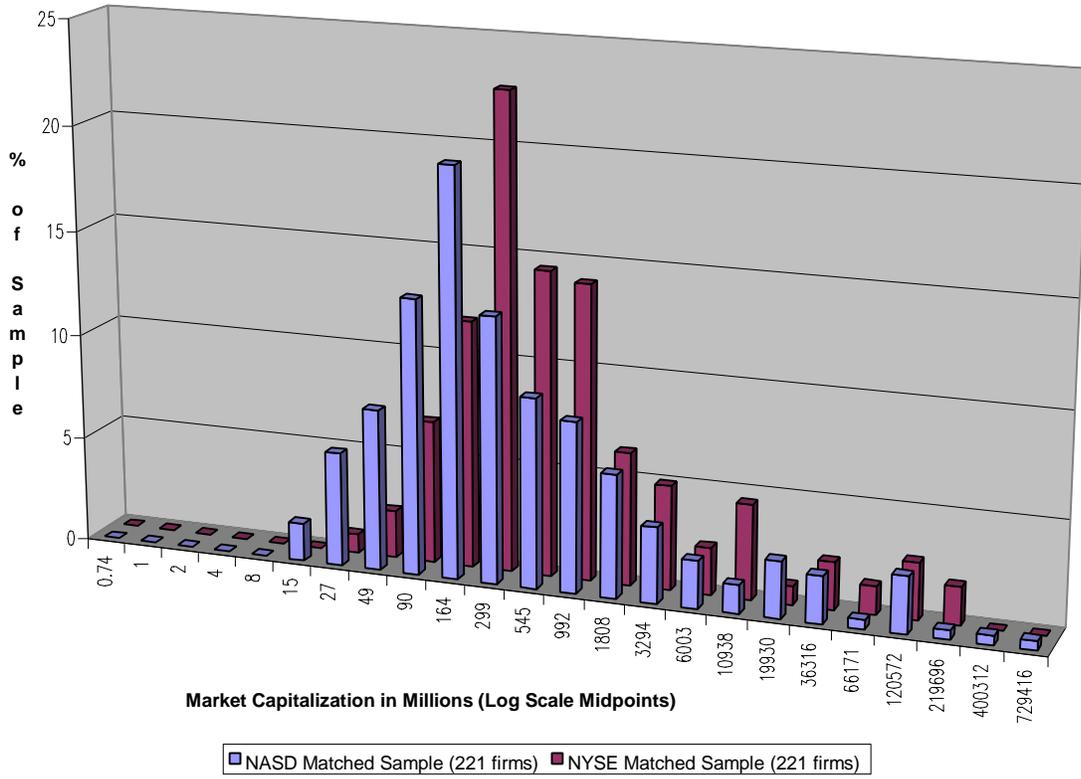
**Histogram of Market Capitalization for the NYSE Versus NASD**



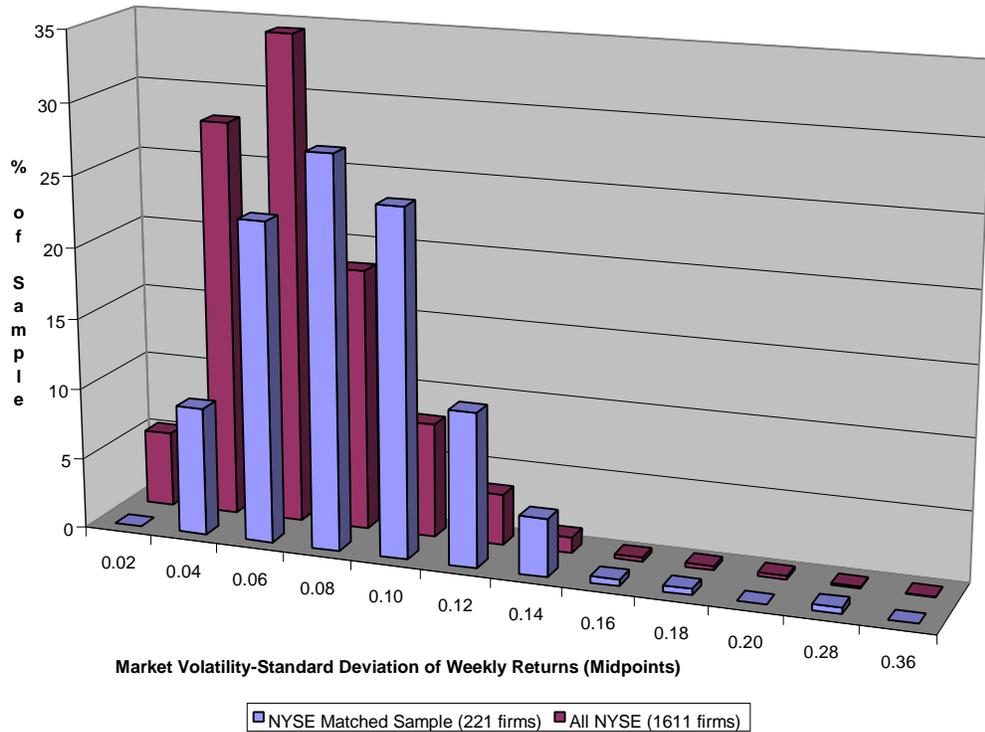
**Histogram of Market Capitalization Comparing NYSE v. NASD**



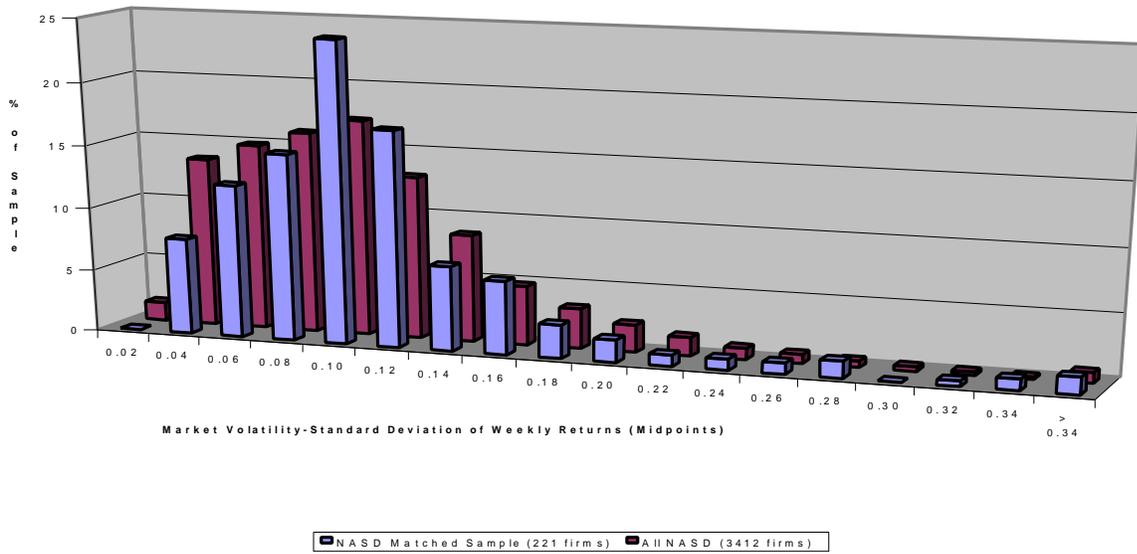
**Histogram of Market Capitalization Comparing NYSE v. NASD**



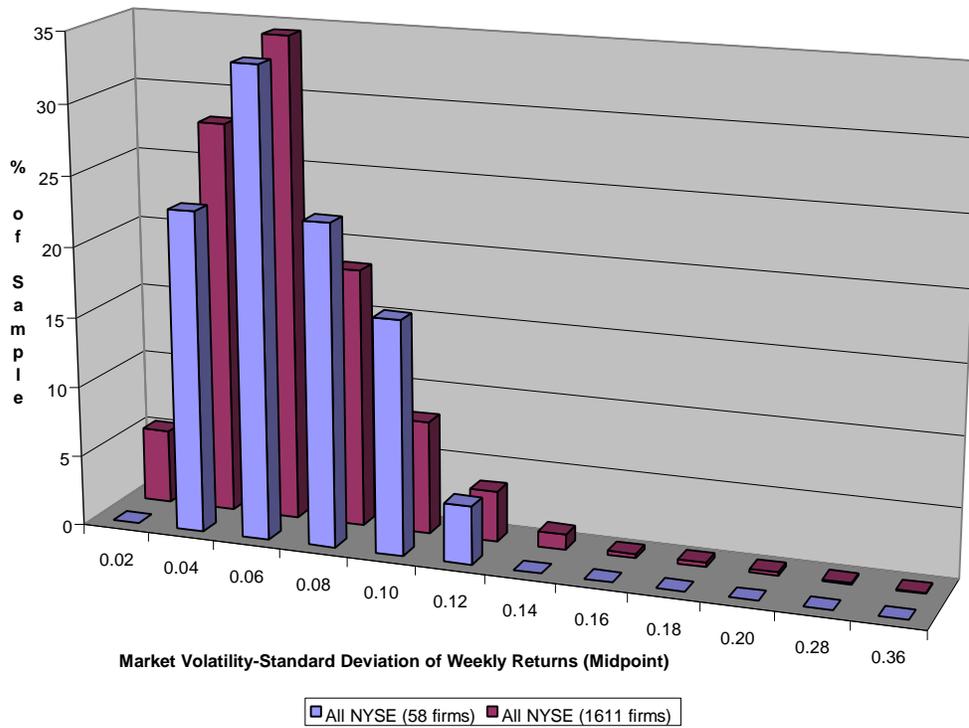
**Histogram of Market Volatility for the NYSE**



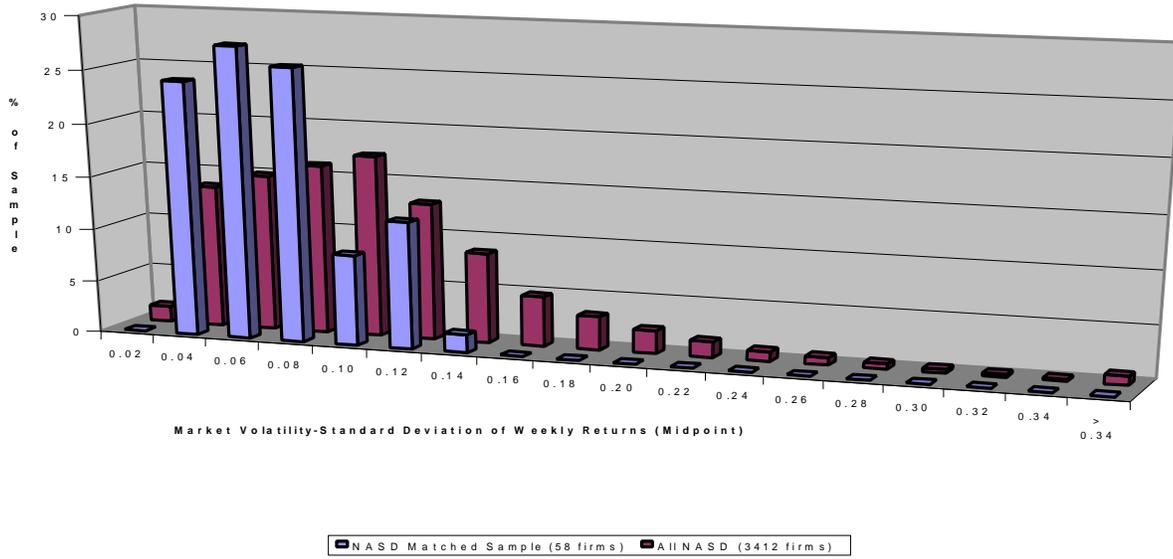
Histogram of Market Volatility for the NASD



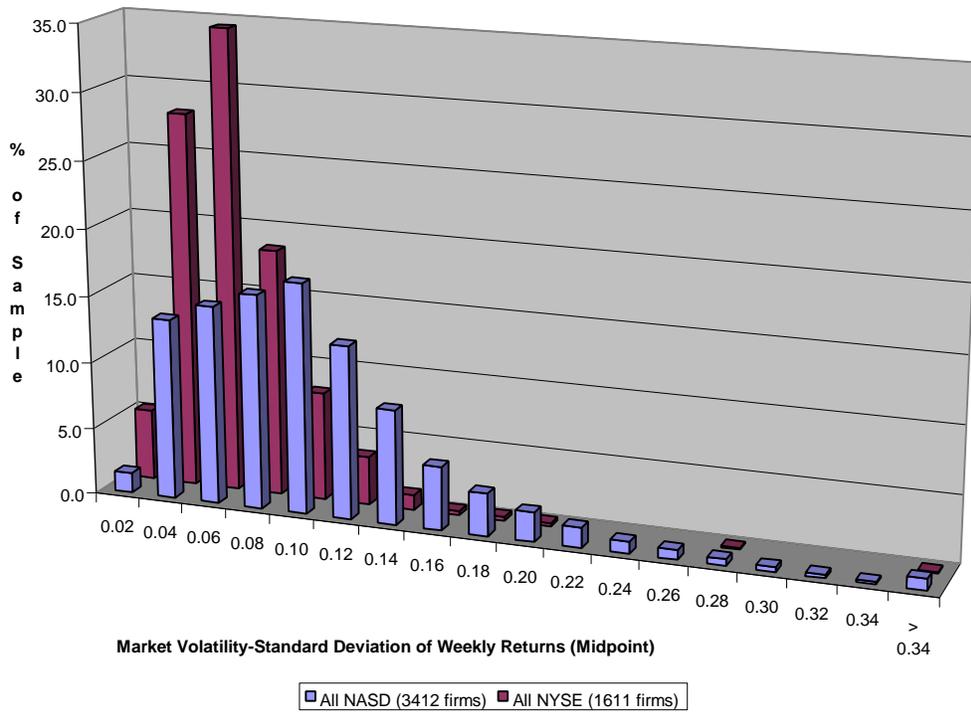
Histogram of Market Volatility for the NYSE



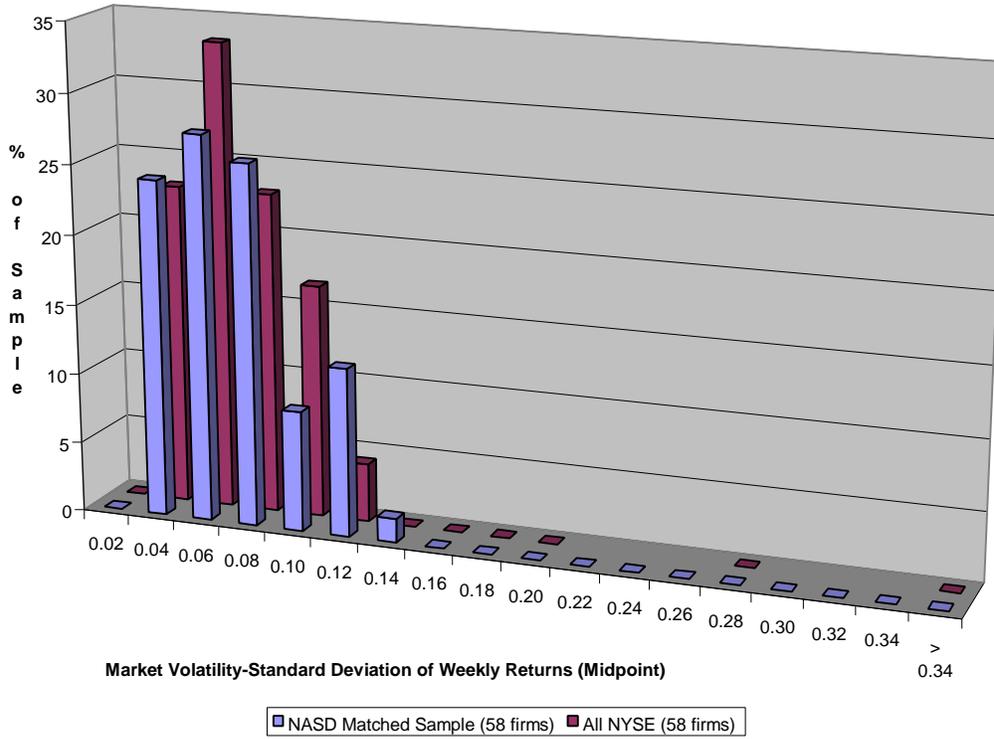
**Histogram of Market Volatility for the NASD**



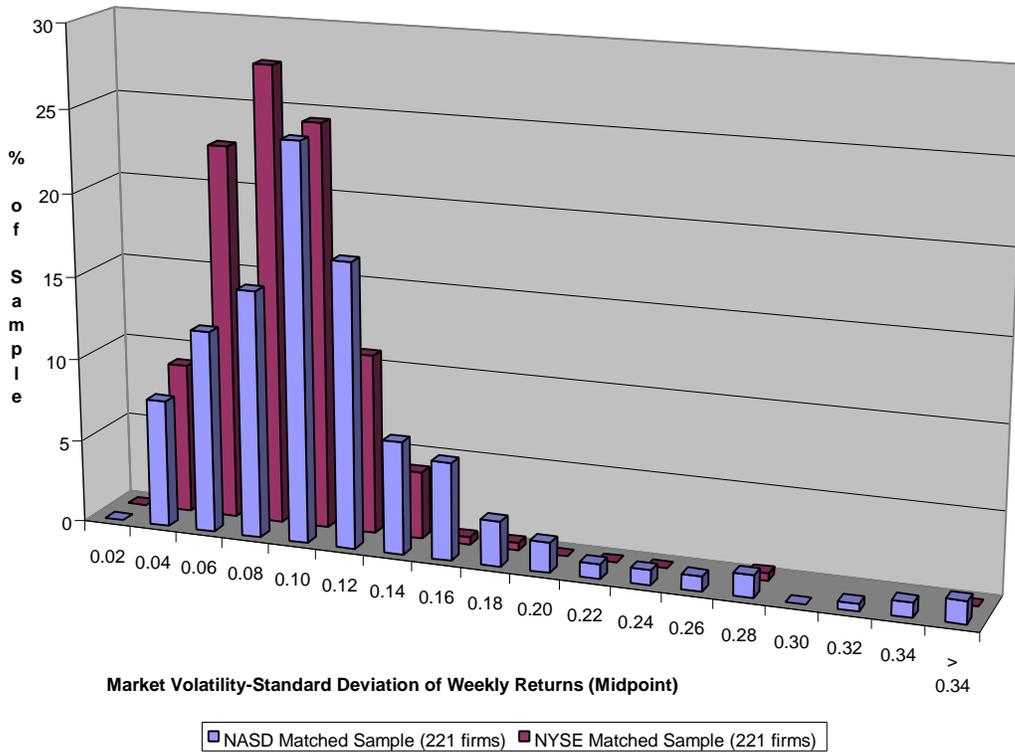
**Histogram of Market Volatility for NYSE Versus NASD**



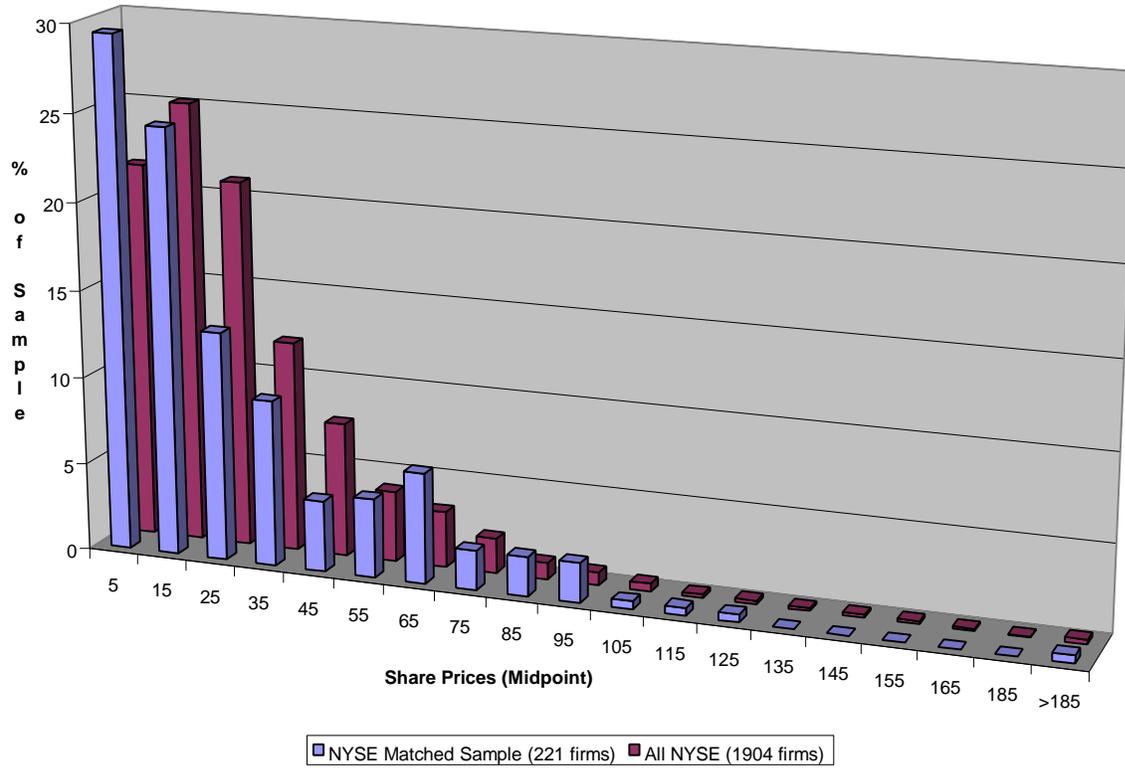
**Histogram of Market Volatility NYSE v. NASD**



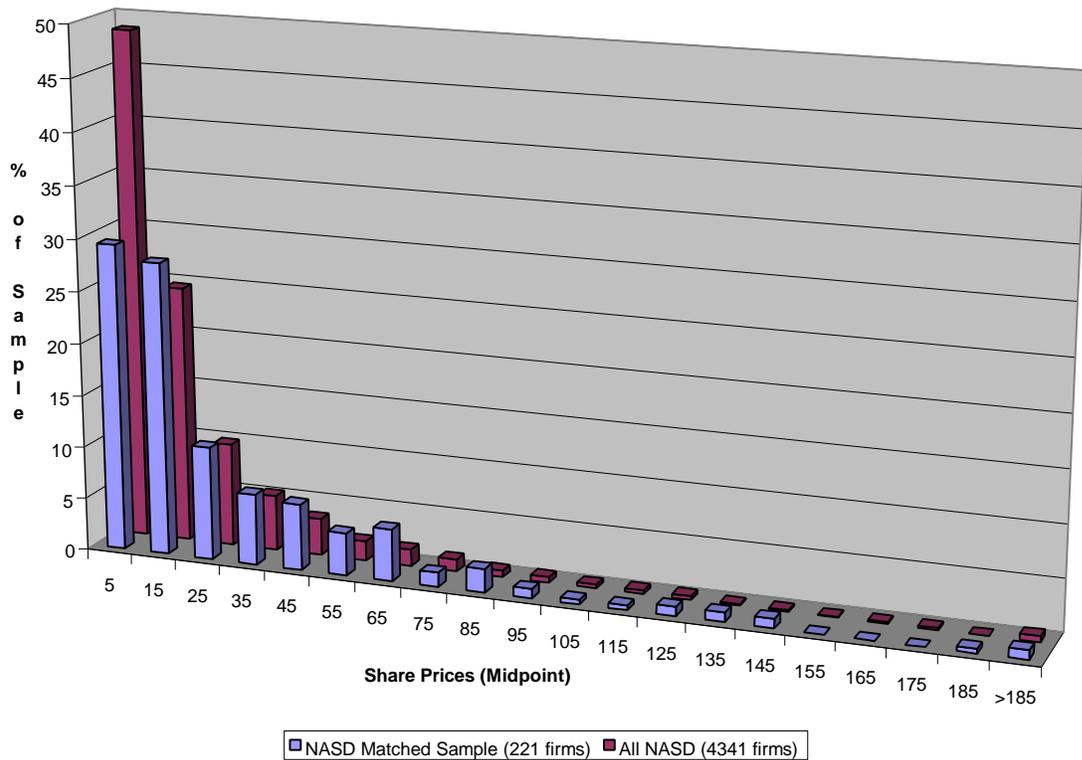
**Histogram of Market Volatility NYSE v. NASD**



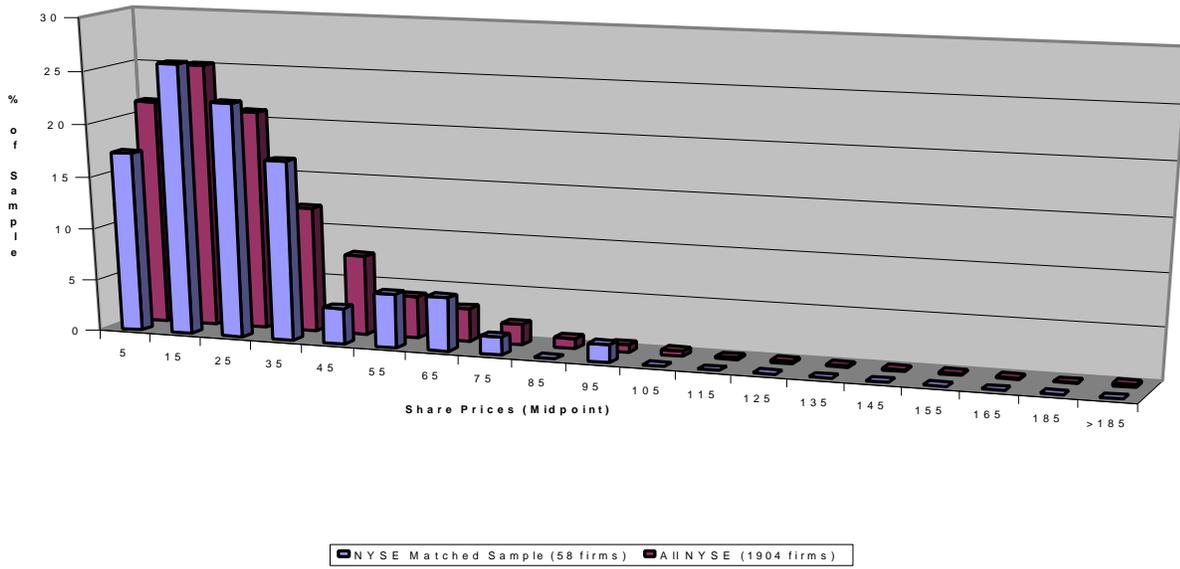
**Histogram of NYSE Share Prices**



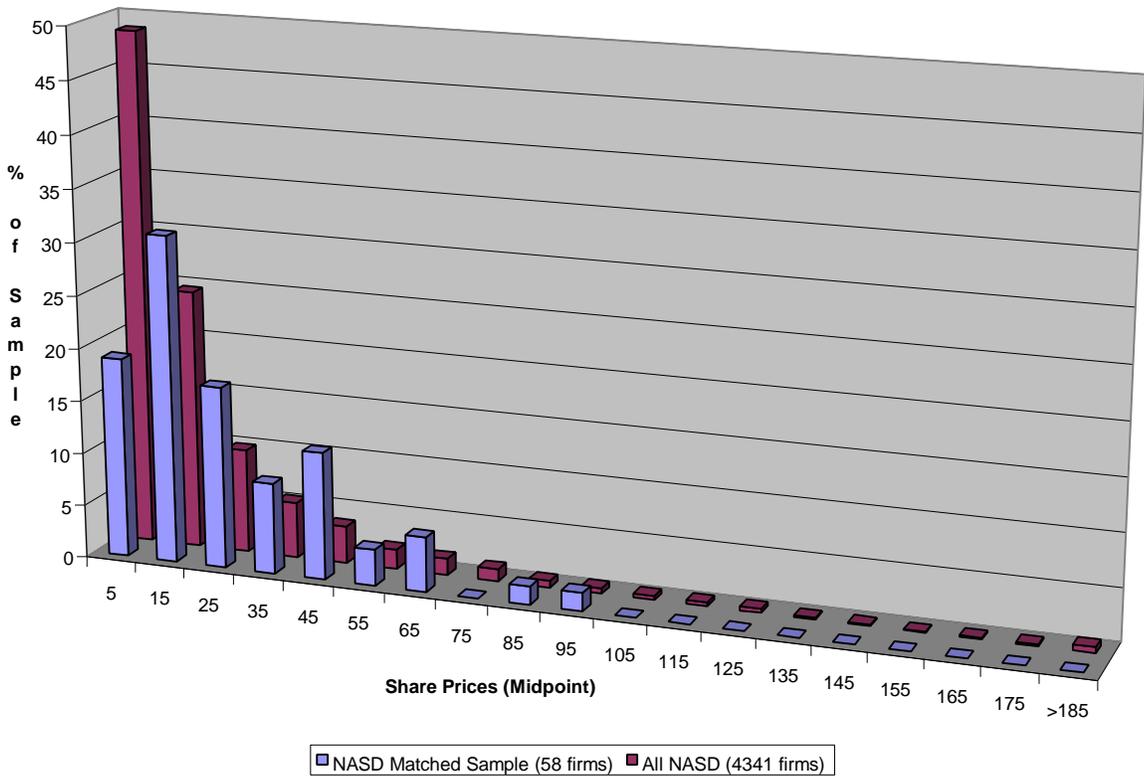
**Histogram of NASD Share Prices**



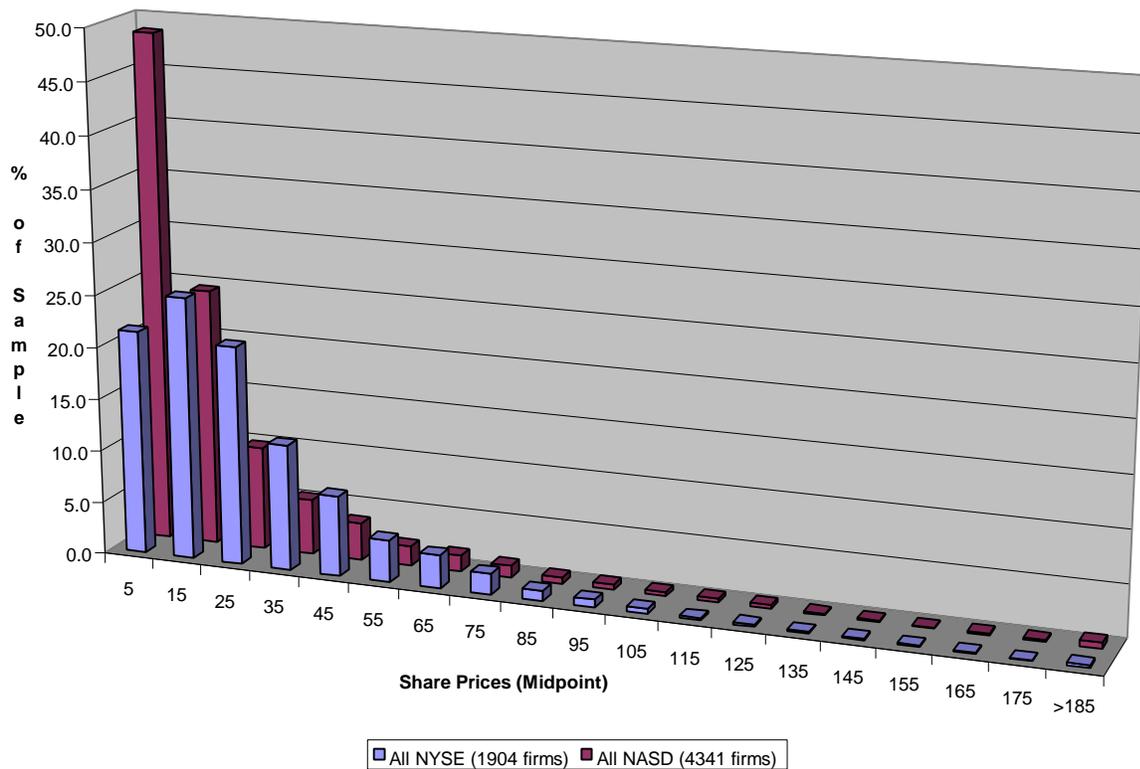
Histogram of NYSE of Share Prices



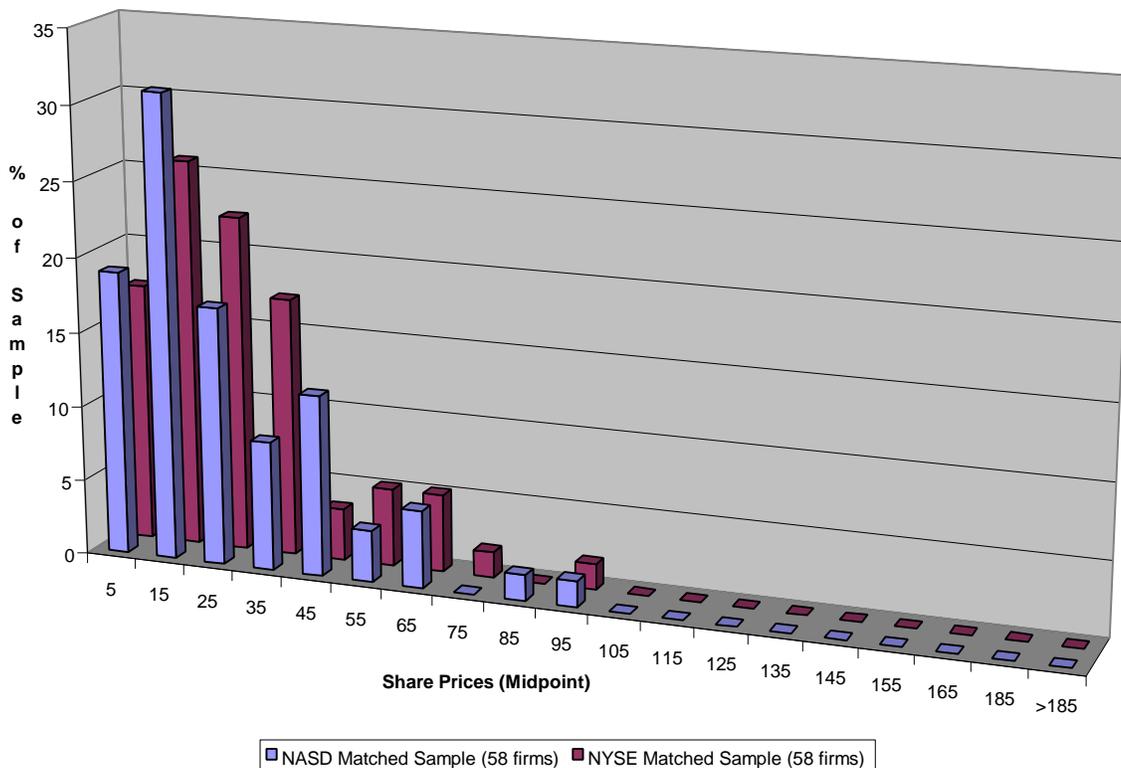
Histogram of NASD Share Prices



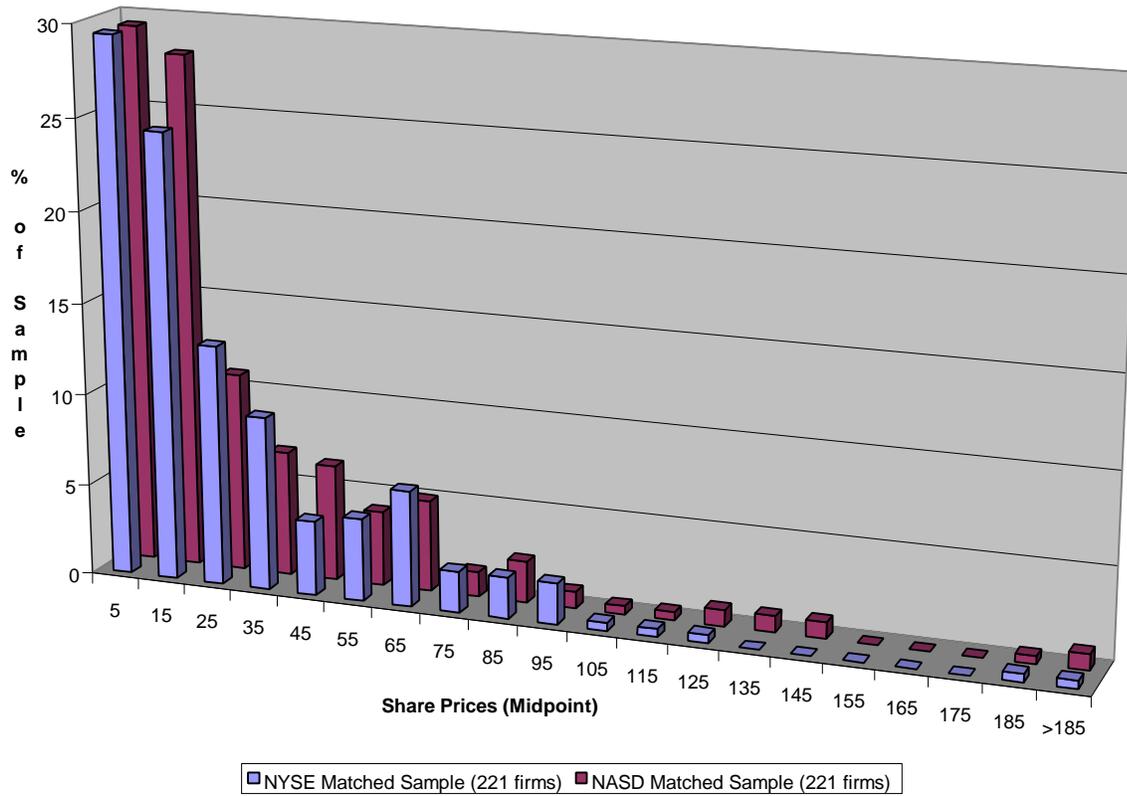
**Histogram of NASD/NYSE Share Prices**



**Histogram of Share Prices NYSE v. NASD**



Histogram of Share Prices NYSE v. NASD



## Appendix C: OATS Execution Prices

### Procedures to Match Executed OATS Records to ACT Trade Reports

The execution price of an order does not exist in the OATS data files. The OATS data was structured so that execution price could be obtained from the NASD ACT file, a separate data base that contains reported trade information. “One of the primary requirements of OATS is the ability to link orders with trades reported in ACT.”<sup>42</sup> We obtained the ACT file and successfully matched approximately 65% of the executed OATS records using the matching algorithms as designed by the NASD. The remaining 35% of the OATS records did not match to the ACT file using the standard match procedure. This appendix documents formatting changes and algorithms we developed to match additional OATS records to the ACT file. Approximately 94% of the OATS records representing 97% of the executed OATS share volume were ultimately matched. Table C1 of this Appendix shows the number and percent of orders matched in each iteration of our match process and Table C3 presents match rates for both market and limit orders. SelectNet orders were matched using a different set of procedures that are described in the last section of this Appendix and the results are presented in Table C2.

The OATS records link to the ACT files based on a set of five variables that uniquely identify the executed OATS order: execution date, issue symbol, reporting market-maker, execution time to the second, and branch sequence number.<sup>43</sup> The branch sequence number is an eight-character alphanumeric variable reported on both files and identifies a particular order. The standard match procedure requires that the files match exactly on each of these five fields.

The ACT file contains records of all Nasdaq executions subject to trade reporting as well as records reported for clearing purposes only.<sup>44</sup> The trade file also includes records for proprietary, desk orders and other trades not subject to OATS reporting. All trade records on the file, including clearing only records were used in the matching process. If the execution time was missing on the trade file the report time was used. Report time is the time the trade was reported to the ACT system.

For some trades, the ACT file also contains the identification of the market-maker/broker-dealer who was the counter party to the trade and the counter party branch sequence number. OATS records that did not match to the reporting side information on the ACT file were matched to the counter party side of the ACT data. The counter side broker identification and counter side branch sequence fields replaced the reporting side

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<sup>42</sup> OATS Reporting Technical Specification, July 29, 1999 Edition, Section 4-7, NASD Regulation.

<sup>43</sup> OATS Reporting Technical Specification, July 29, 1999 Edition, Section 6-5, NASD Regulation.

<sup>44</sup> The trade file includes records for publicly reported trades and clearing-only records. Clearing records are reported for odd-lot transactions that are not publicly reported, and for some ECN executions in addition to the public trade report. The trade file has information on the executed quantity, reporting and contra side broker, buy/sell indicator, execution time, report time to ACT, executed price, but has no order information such as order time, market or limit indicator, limit price, order quantity or originating broker.

fields for the match. The reporting side execution time was used for the match. Less than 1% of matches were added using the counter side information.

Routed orders are sent from one market center to another for execution and generate a routing record in addition to a new order record. (This description does not apply to SelectNet routed orders). The new order record produced by the second market center contains the information necessary for the standard matching process. The first or routed record does not. This information was attached to the routed order report and then matched to the trade file. The match process uses the sent\_to field instead of the mp\_id field on the OATS file to obtain a correct match. The standard firm variable match procedure was used for these records. These orders are included in Table C1 and represent about 3% of the total executed OATS records.

Our review of the unmatched OATS records showed that many records were failing to match due to differences in the formatting of the branch sequence number on the OATS and ACT files. We determined that reformatting the branch sequence numbers, and making two market center specific adjustments would result in additional matches with no loss in accuracy. Generally, the formatting corrections affected the trade file, although the adjustments were applied to branch sequence numbers on both the OATS and the trade files. The formatting corrections that we implemented are as follows:

1. The branch sequence number for a trade has a blank in middle of the string on one file but no blank in the other file. The branch sequence numbers were compressed to delete the blank in the middle of the strings.

Before (file 1)	abcd 123
(file 2)	abcd123
After correction	abcd123

2. Trailing zeros on the Branch Sequence on one file but not on the other file.

Before (file 1)	abcd1200
(file 2)	abcd12
After correction (both files)	abcd12

3. Market Center N1 Correction: Branch sequence numbers with a blank in middle of a string followed by leading zeros in positions 5, 6, and/or 7. Corresponding record has no blank or zeroes, or has different number of zeroes. This and formatting adjustments 1 and 2 increased the match rate from 64.6% to 75.8%.

Before (file 1)	abcd 004, abcd 04, etc.
(file 2)	abcd04 or abcd4
After Correction (both files)	abcd4

4. Market Center N2 Correction: For this market center, there sometimes were two OATS orders with different branch sequence numbers that execute against each other but generate only one matching report on the trade file. The two OATS branch sequence

numbers are identical except for the last character, which is 's' on one order and 'b' on the other. The corresponding trade record has a branch sequence number that matches one of the OATS records. We allowed the trade record to match with both of the OATS records. The correction was made by stripping the 'b' and 's' from the branch sequence number for this firm's records for this specific iteration of the match process. This adjustment increased the percent of matched OATS records from 76.5% to 87.8%.

OATS Branch Seq	1 <sup>st</sup> ord.	abcd123b
	2 <sup>nd</sup> ord.	abcd123s
Trade Report Branch Seq		abcd123b

#### Other Procedures to Match

In the next phase, the unmatched OATS records are matched to the trade file by adding and deleting (for purposes of matching) variables from the standard five variable set (see summary table below). ACT trade records that previously matched with OATS records were excluded for the remaining match process. In this phase, orders and trades were matched only when there was one observation as defined by the matching criteria. For example, if there were multiple observations with identical, date, stock symbol, market center, branch sequence number and executed quantity on either the OAT or ACT file, the match was not attempted for the records. In requiring that records be unique, we protect against selecting an incorrect match when there is more than one record to choose from. The three steps in this phase are described below.

First, execution time was dropped and executed quantity was substituted as a match variable. The other standard variables, date, symbol, market center, and branch sequence were retained as matching variables. This step increased the match rate from 87.8% to 88.5%.

In the second step, the branch sequence number was dropped as a match variable and the match was rerun using same variables as step one. For a successful match, the OATS record had to match the trade file on the basis of date, stock, market center, execution time to the second, and the share quantity executed. In addition, trades previously used in earlier iterations were not available for the match. This process increased the match rate of executed OATS records from 88.5% to 89.9%.

The third step is identical to step 2, except that the matches are permitted when execution times are within the same half-minute. Execution times in the first half-minute are rounded to the earlier minute, and execution times in the second half-minute are rounded to the next minute. This allows, for example, a record with a 10:00:01 time to match with a 10:00:29 record when each of the other variables also match. This increased the match rate from 89.9% to 90.6%.<sup>45</sup>

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<sup>45</sup> A final step dropped the market center from the matching algorithm and produced 59 additional matches for the entire week.

### Summary of Other Match Procedures

	Date, Stock, Market Center	Branch Sequence	Execution Time	Quantity Executed
Standard Method Uses	Y	Y	Y	N
Step1	Y	Y	N	Y
Step 2	Y	N	Y	Y
Step 3	Y	N	Y (Approx. Time)	Y

### Matching Orders Routed Through SelectNet

OATS orders routed through SelectNet have no information on the status of the order, and do not have the execution time or quantity for orders that do execute. Unlike orders routed through non-Nasdaq systems, SelectNet orders do not generate a second order report from the receiving market center. Therefore, the routed SelectNet order is the only record for these orders. According to the NASD, the OATS SelectNet orders can be matched to the ACT file using the routed order identification that appears in the OATS file instead of the branch sequence number.

After removing trailing zeros and blanks from the routed order number, the OATS SelectNet orders were matched to the ACT file based on routed order number, date, stock symbol, and market center (no execution time). Approximately 13% of the SelectNet OATS records matched to its corresponding trade on the ACT file. Since OATS does not indicate if routed SelectNet orders were executed, the percent of executed orders that we successfully matched is unknown.

In order to determine the status of the remaining SelectNet orders, and to attach the execution information to executed orders, we requested the SelectNet order and response files from the NASD for the 221 sample stocks. These two sets of files contain SelectNet order and SelectNet execution information, and include orders that are not OATS reportable events. The SelectNet order and response files were merged together by date and order identification number. However, the NASD SelectNet data has no fields to directly link it to the OATS SelectNet records. We developed algorithms to match the OATS and SelectNet files which are described below. The results of the match are presented in Table C2 of this Appendix.

The criteria utilized to match records were as follows: date, market center, stock symbol, buy/sell indicator, quantity, order time, and for limit orders the limit price. The OATS records have both the order receive time and time the order was sent to SelectNet. The SelectNet files contain the time the order was received by SelectNet. However, since the SelectNet time stamp sometimes precedes the OATS time sent by a few seconds, the OATS time receive time was used for the match. Beginning with the OATS time received, the first SelectNet record within 60 seconds, to match on each of the above criteria was selected. If a SelectNet order that matched each of the criteria was not found with a time that was within 60 seconds of the OATS time, the record did not match.

In the second iteration of this process, matches were permitted if for buy (sell) limit orders, the SelectNet price was equal to or less (greater) than the OATS limit price. The step allows for matches with unequal prices since SelectNet orders sometimes contain a price that is revised from the original OATS price. Once used for a match, the SelectNet order was removed and was not available for further matches.

Approximately 73% of the OATS records routed to SelectNet were successfully matched to the SelectNet file. Executed orders represented 38% of the OATS SelectNet orders and unexecuted orders represented 35%. OATS SelectNet records that did not match and therefore their status is unknown, accounted for 26% of the records.

Table C1: Results of Match Process for June 5-9, 2000 221 Stock Sample Data

	<b>OATS Orders that Match with Trade File</b> (a)	<b>Cumulative Number of Matches</b> (b)	<b>Total Number of Executed Oats Records *</b> (c)	<b>Matched OATS Records as % of Total</b> (b)/(c)
No adjustments Standard Merge Process(Includes Non-SelectNet Routed Orders)	1,826,865	1,826,865	2,828,071	64.6%
Remove blanks, trailing 0s, and specific reformatting for Market Center N1	316,449	2,143,314	2,828,071	75.8%
Match OATS with Contra Side Info. on ACT File	21,304	2,164,617	2,828,071	76.5%
Market Center N2 Branch Sequence Adjustment (match 1 trade print to 2 OATS orders)	319,650	2,484,268	2,828,071	87.8%
Execution Time Dropped and Execution Qty Added as Match Variables	19,953	2,504,221	2,828,071	88.5%
Branch Seq Dropped, Date, Stock, MP_ID, Xtime, QTY are Match Variables	37,158	2,541,379	2,828,071	89.9%
Time to 30 seconds Replaces Exact Time	22,106	2,563,485	2,828,071	90.6%
Same as Above, Drop MP_ID, Add Branch Sequence	59	2,563,544	2,828,071	90.6%
Total		2,563,544	2,828,071	90.6%
Total A **	-	2,307,408	2,457,702	93.9%

\*Included are 91,544 routed order records from market-makers and orders routed to ECN's, excluding SelectNet.

\*\*Excludes odd lots, and orders with exception reports or special handling codes.

**Table C2: Selectnet Orders Results of Match Process, 221 Stock Sample**

<i>OATS Orders that:</i>	<b>Number (a)</b>	<b>Cumulative Total (b)</b>	<b>Total Number of OATS SelectNet Orders (c)</b>	<b>Number as % of Total OATS SelectNet Orders (a/c)</b>	<b>Cum Total as % (b/c)</b>
Matched to the SelectNet or ACT File and Executed *	119,619	119,619	313,053	38.2%	38.2%
Matched to SelectNet File but did not Execute	109,904	229,523	313,053	35.1%	73.3%
Did not match – Disposition Unknown	80,531	310,054	313,053	25.7%	99.0%
Matched as Partial Executions - no execution price on SelectNet File (199 stock sample only)	2,999	313,053	313,053	1.0%	100%

\* Approximately 13% of the OATS orders matched to the ACT file using the routed order identification. For the 199 stock sample, orders that matched to either the ACT file or the SelectNet file are included. For the 22 stocks added later, the sample includes those OATS orders that matched to the SelectNet files.

Table C3: Match Rate by Order Type – Corresponds to Table C1 Total A  
 (Excludes Orders Routed to Nasdaq Execution Systems) June 5-9, 2000, Sample of 221

	<b>Number of Orders Matched</b>	<b>Total Number of Orders</b>	<b>% Matched</b>	<b>% of Executed Volume Matched</b>
Market Orders	543,017	555,234	97.8%	99.1%
Limit Orders	1,764,391	1,902,468	92.7%	96.1%
Total	2,307,408	2,457,702	93.9%	96.7%

Appendix D: Summary of Executed Orders and Executed Shares

Appendix D. Summary of Executed Orders and Executed Shares  
Firms in All Size Categories

	Nasdaq						NYSE					
	Executed Orders (000's)			Executed Shares (000's)			Executed Orders (000's)			Executed Shares (000's)		
	Total	Percent of...		Total	Percent of...		Total	Percent of...		Total	Percent of...	
Ord. Typ.		All Ords.	Ord. Typ.		All Ords.	Ord. Typ.		All Ords.	Ord. Typ.		All Ords.	
<b>Market Orders</b>												
100-499 Shares	1,341	71.1%	21.2%	249,775	27.9%	6.6%	653	54.1%	26.2%	124,053	11.5%	4.0%
500-199 Shares	477	25.3%	7.5%	366,481	40.9%	9.6%	425	35.2%	17.1%	342,444	31.7%	10.9%
2000-4999 Shares	54	2.9%	0.9%	135,022	15.1%	3.5%	93	7.7%	3.7%	238,984	22.1%	7.6%
5000+ Shares	15	0.8%	0.2%	144,096	16.1%	3.8%	37	3.1%	1.5%	374,687	34.7%	12.0%
<b>Total Market Orders</b>	<b>1,887</b>	<b>100.0%</b>	<b>29.9%</b>	<b>895,373</b>	<b>100.0%</b>	<b>23.5%</b>	<b>1,208</b>	<b>100.0%</b>	<b>48.5%</b>	<b>1,080,167</b>	<b>100.0%</b>	<b>34.5%</b>
<b>Marketable Limit Orders</b>												
100-499 Shares	1,141	48.8%	18.1%	209,700	13.3%	5.5%	155	32.9%	6.2%	31,603	3.7%	1.0%
500-199 Shares	1,009	43.2%	16.0%	716,819	45.6%	18.8%	193	41.2%	7.8%	167,483	19.4%	5.3%
2000-4999 Shares	126	5.4%	2.0%	258,306	16.4%	6.8%	72	15.4%	2.9%	186,200	21.6%	5.9%
5000+ Shares	61	2.6%	1.0%	387,690	24.7%	10.2%	49	10.4%	2.0%	475,992	55.3%	15.2%
<b>At the Quote Limit Orders</b>												
100-499 Shares	369	53.4%	5.8%	61,127	18.6%	1.6%	147	41.4%	5.9%	29,436	6.8%	0.9%
500-199 Shares	290	41.9%	4.6%	184,003	56.1%	4.8%	147	41.5%	5.9%	120,179	27.6%	3.8%
2000-4999 Shares	23	3.4%	0.4%	40,081	12.2%	1.1%	39	11.1%	1.6%	98,270	22.6%	3.1%
5000+ Shares	9	1.3%	0.1%	42,754	13.0%	1.1%	21	5.9%	0.8%	187,449	43.1%	6.0%
<b>Inside the Quote Limit Orders</b>												
100-499 Shares	535	48.9%	8.5%	96,523	12.0%	2.5%	155	39.4%	6.2%	29,788	4.7%	1.0%
500-199 Shares	468	42.7%	7.4%	346,605	43.1%	9.1%	151	38.6%	6.1%	134,090	21.1%	4.3%
2000-4999 Shares	57	5.2%	0.9%	123,337	15.3%	3.2%	53	13.4%	2.1%	138,621	21.8%	4.4%
5000+ Shares	35	3.2%	0.6%	238,525	29.6%	6.3%	34	8.6%	1.4%	332,154	52.3%	10.6%
<b>Near the Quote Limit Orders</b>												
100-499 Shares	158	52.1%	2.5%	28,436	13.9%	0.7%	25	38.3%	1.0%	4,504	3.8%	0.1%
500-199 Shares	123	40.6%	2.0%	91,219	44.5%	2.4%	25	38.7%	1.0%	22,023	18.5%	0.7%
2000-4999 Shares	15	4.8%	0.2%	31,845	15.5%	0.8%	9	13.7%	0.4%	22,783	19.1%	0.7%
5000+ Shares	7	2.5%	0.1%	53,513	26.1%	1.4%	6	9.3%	0.2%	69,965	58.7%	2.2%
<b>Total Limit Orders</b>	<b>4,427</b>		<b>70.1%</b>	<b>2,910,485</b>		<b>76.5%</b>	<b>1,282</b>		<b>51.5%</b>	<b>2,050,541</b>		<b>65.5%</b>
<b>Grand Total</b>	<b>6,313</b>			<b>3,805,858</b>			<b>2,490</b>			<b>3,130,708</b>		

Appendix D. Summary of Executed Orders and Executed Shares  
Firms in Very Large Size Category

	Nasdaq						NYSE					
	Executed Orders (000's)			Executed Shares (000's)			Executed Orders (000's)			Executed Shares (000's)		
	Total	Percent of...		Total	Percent of...		Total	Percent of...		Total	Percent of...	
	Ord. Typ.	All Ords.		Ord. Typ.	All Ords.		Ord. Typ.	All Ords.		Ord. Typ.	All Ords.	
<b>Market Orders</b>												
100-499 Shares	1,144	72.2%	21.6%	212,803	29.0%	6.7%	495	54.7%	28.4%	93,295	11.3%	4.2%
500-199 Shares	387	24.4%	7.3%	296,003	40.4%	9.3%	310	34.3%	17.8%	250,005	30.3%	11.2%
2000-4999 Shares	41	2.6%	0.8%	102,831	14.0%	3.2%	70	7.7%	4.0%	179,169	21.7%	8.1%
5000+ Shares	12	0.7%	0.2%	121,437	16.6%	3.8%	30	3.4%	1.7%	301,724	36.6%	13.6%
<b>Total Market Orders</b>	<b>1,584</b>	<b>100.0%</b>	<b>29.9%</b>	<b>733,074</b>	<b>100.0%</b>	<b>23.1%</b>	<b>905</b>	<b>100.0%</b>	<b>51.9%</b>	<b>824,194</b>	<b>100.0%</b>	<b>37.1%</b>
<b>Marketable Limit Orders</b>												
100-499 Shares	953	48.6%	18.0%	175,914	13.4%	5.6%	98	32.5%	5.6%	20,073	3.5%	0.9%
500-199 Shares	859	43.9%	16.2%	611,061	46.5%	19.3%	124	41.1%	7.1%	107,778	18.9%	4.8%
2000-4999 Shares	99	5.1%	1.9%	205,073	15.6%	6.5%	47	15.7%	2.7%	123,526	21.6%	5.6%
5000+ Shares	48	2.4%	0.9%	321,121	24.5%	10.1%	32	10.7%	1.8%	320,386	56.0%	14.4%
<b>At the Quote Limit Orders</b>												
100-499 Shares	292	52.8%	5.5%	47,767	18.9%	1.5%	84	39.7%	4.8%	17,118	6.0%	0.8%
500-199 Shares	240	43.4%	4.5%	152,244	60.1%	4.8%	89	41.9%	5.1%	73,001	25.7%	3.3%
2000-4999 Shares	16	2.9%	0.3%	26,811	10.6%	0.8%	25	11.7%	1.4%	63,124	22.2%	2.8%
5000+ Shares	5	0.9%	0.1%	26,524	10.5%	0.8%	14	6.7%	0.8%	131,151	46.1%	5.9%
<b>Inside the Quote Limit Orders</b>												
100-499 Shares	446	48.4%	8.4%	80,374	11.7%	2.5%	109	39.7%	6.2%	20,953	4.7%	0.9%
500-199 Shares	402	43.5%	7.6%	298,505	43.5%	9.4%	106	38.5%	6.1%	93,932	21.0%	4.2%
2000-4999 Shares	47	5.0%	0.9%	101,495	14.8%	3.2%	37	13.4%	2.1%	97,671	21.8%	4.4%
5000+ Shares	28	3.1%	0.5%	205,924	30.0%	6.5%	23	8.3%	1.3%	234,851	52.5%	10.6%
<b>Near the Quote Limit Orders</b>												
100-499 Shares	142	52.3%	2.7%	25,215	13.9%	0.8%	20	38.8%	1.2%	3,666	3.8%	0.2%
500-199 Shares	110	40.8%	2.1%	81,518	45.1%	2.6%	20	38.1%	1.1%	17,540	18.2%	0.8%
2000-4999 Shares	12	4.6%	0.2%	26,911	14.9%	0.8%	7	13.8%	0.4%	18,492	19.1%	0.8%
5000+ Shares	6	2.3%	0.1%	47,243	26.1%	1.5%	5	9.3%	0.3%	56,869	58.9%	2.6%
<b>Total Limit Orders</b>	<b>3,706</b>		<b>70.1%</b>	<b>2,433,699</b>		<b>76.9%</b>	<b>840</b>		<b>48.1%</b>	<b>1,400,129</b>		<b>62.9%</b>
<b>Grand Total</b>	<b>5,290</b>			<b>3,166,773</b>			<b>1,745</b>			<b>2,224,323</b>		

Appendix D. Summary of Executed Orders and Executed Shares  
Firms in Large Size Category

	Nasdaq						NYSE					
	Executed Orders (000's)			Executed Shares (000's)			Executed Orders (000's)			Executed Shares (000's)		
	Total	Percent of...		Total	Percent of...		Total	Percent of...		Total	Percent of...	
Ord. Typ.		All Ords.	Ord. Typ.		All Ords.	Ord. Typ.		All Ords.	Ord. Typ.		All Ords.	
<b>Market Orders</b>												
100-499 Shares	115	75.1%	19.5%	20,482	31.6%	7.1%	110	53.7%	24.3%	21,318	13.5%	4.7%
500-199 Shares	33	21.6%	5.6%	24,836	38.3%	8.6%	77	37.4%	16.9%	61,015	38.7%	13.6%
2000-4999 Shares	4	2.5%	0.6%	9,370	14.4%	3.2%	15	7.2%	3.3%	37,345	23.7%	8.3%
5000+ Shares	1	0.8%	0.2%	10,181	15.7%	3.5%	3	1.7%	0.8%	37,920	24.1%	8.4%
<b>Total Market Orders</b>	<b>153</b>	<b>100.0%</b>	<b>26.0%</b>	<b>64,869</b>	<b>100.0%</b>	<b>22.4%</b>	<b>205</b>	<b>100.0%</b>	<b>45.3%</b>	<b>157,598</b>	<b>100.0%</b>	<b>35.1%</b>
<b>Marketable Limit Orders</b>												
100-499 Shares	132	57.9%	22.4%	22,830	19.5%	7.9%	34	36.1%	7.6%	7,118	5.6%	1.6%
500-199 Shares	80	35.0%	13.5%	52,265	44.5%	18.1%	40	42.7%	8.9%	34,299	27.1%	7.6%
2000-4999 Shares	9	4.0%	1.5%	17,263	14.7%	6.0%	13	14.1%	3.0%	32,078	25.4%	7.1%
5000+ Shares	7	3.0%	1.2%	24,977	21.3%	8.6%	7	7.0%	1.5%	52,908	41.9%	11.8%
<b>At the Quote Limit Orders</b>												
100-499 Shares	58	62.6%	9.9%	9,573	24.0%	3.3%	40	47.2%	8.8%	7,805	9.6%	1.7%
500-199 Shares	30	32.2%	5.1%	17,173	43.1%	5.9%	34	39.7%	7.4%	26,761	32.9%	6.0%
2000-4999 Shares	3	3.1%	0.5%	5,131	12.9%	1.8%	8	8.9%	1.7%	18,046	22.2%	4.0%
5000+ Shares	2	2.2%	0.3%	7,990	20.0%	2.8%	4	4.1%	0.8%	28,745	35.3%	6.4%
<b>Inside the Quote Limit Orders</b>												
100-499 Shares	58	59.3%	9.9%	10,002	17.3%	3.5%	28	45.6%	6.1%	5,318	7.2%	1.2%
500-199 Shares	33	33.2%	5.6%	22,374	38.6%	7.7%	23	37.6%	5.0%	19,518	26.3%	4.3%
2000-4999 Shares	4	4.0%	0.7%	8,236	14.2%	2.8%	6	10.6%	1.4%	16,642	22.4%	3.7%
5000+ Shares	3	3.4%	0.6%	17,370	30.0%	6.0%	4	6.2%	0.8%	32,680	44.1%	7.3%
<b>Near the Quote Limit Orders</b>												
100-499 Shares	10	61.8%	1.7%	1,836	20.3%	0.6%	3	42.2%	0.7%	609	6.4%	0.1%
500-199 Shares	5	31.8%	0.9%	3,433	38.0%	1.2%	3	40.8%	0.7%	2,651	27.8%	0.6%
2000-4999 Shares	1	3.5%	0.1%	1,185	13.1%	0.4%	1	11.2%	0.2%	2,184	22.9%	0.5%
5000+ Shares	0	2.9%	0.1%	2,570	28.5%	0.9%	0	5.8%	0.1%	4,081	42.9%	0.9%
<b>Total Limit Orders</b>	<b>436</b>		<b>74.0%</b>	<b>224,208</b>		<b>77.6%</b>	<b>248</b>		<b>54.7%</b>	<b>291,442</b>		<b>64.9%</b>
<b>Grand Total</b>	<b>589</b>			<b>289,077</b>			<b>453</b>			<b>449,040</b>		

Appendix D. Summary of Executed Orders and Executed Shares  
Firms in Medium Size Category

	Nasdaq						NYSE					
	Executed Orders (000's)			Executed Shares (000's)			Executed Orders (000's)			Executed Shares (000's)		
	Total	Percent of...		Total	Percent of...		Total	Percent of...		Total	Percent of...	
Ord. Typ.		All Ords.	Ord. Typ.		All Ords.	Ord. Typ.		All Ords.	Ord. Typ.		All Ords.	
<b>Market Orders</b>												
100-499 Shares	63	56.9%	19.0%	12,602	18.4%	5.3%	34	48.6%	16.7%	6,588	9.5%	2.2%
500-199 Shares	40	36.4%	12.2%	32,064	46.8%	13.4%	27	39.6%	13.6%	22,256	32.3%	7.3%
2000-4999 Shares	6	5.6%	1.9%	15,113	22.1%	6.3%	6	8.6%	3.0%	16,062	23.3%	5.3%
5000+ Shares	1	1.2%	0.4%	8,691	12.7%	3.6%	2	3.2%	1.1%	24,102	34.9%	7.9%
<b>Total Market Orders</b>	<b>110</b>	<b>100.0%</b>	<b>33.5%</b>	<b>68,470</b>	<b>100.0%</b>	<b>28.5%</b>	<b>69</b>	<b>100.0%</b>	<b>34.3%</b>	<b>69,008</b>	<b>100.0%</b>	<b>22.7%</b>
<b>Marketable Limit Orders</b>												
100-499 Shares	47	40.6%	14.1%	8,912	9.5%	3.7%	16	31.5%	7.8%	3,044	2.8%	1.0%
500-199 Shares	53	46.1%	16.0%	39,322	41.8%	16.4%	20	40.1%	10.0%	17,292	16.2%	5.7%
2000-4999 Shares	11	10.0%	3.5%	23,330	24.8%	9.7%	8	15.4%	3.8%	20,088	18.8%	6.6%
5000+ Shares	4	3.3%	1.2%	22,487	23.9%	9.4%	7	13.1%	3.3%	66,637	62.2%	21.9%
<b>At the Quote Limit Orders</b>												
100-499 Shares	15	44.4%	4.7%	3,026	12.7%	1.3%	18	42.5%	8.7%	3,447	7.2%	1.1%
500-199 Shares	15	43.9%	4.6%	10,840	45.3%	4.5%	17	41.1%	8.4%	13,917	28.9%	4.6%
2000-4999 Shares	3	7.8%	0.8%	4,985	20.9%	2.1%	4	10.6%	2.2%	11,117	23.1%	3.7%
5000+ Shares	1	3.9%	0.4%	5,054	21.1%	2.1%	2	5.8%	1.2%	19,613	40.8%	6.4%
<b>Inside the Quote Limit Orders</b>												
100-499 Shares	25	43.9%	7.6%	4,927	11.6%	2.1%	12	32.6%	6.1%	2,418	3.4%	0.8%
500-199 Shares	26	44.8%	7.7%	19,361	45.6%	8.1%	15	39.6%	7.4%	13,491	18.8%	4.4%
2000-4999 Shares	4	7.4%	1.3%	8,915	21.0%	3.7%	6	15.6%	2.9%	15,679	21.8%	5.2%
5000+ Shares	2	3.8%	0.7%	9,283	21.8%	3.9%	5	12.2%	2.3%	40,322	56.1%	13.3%
<b>Near the Quote Limit Orders</b>												
100-499 Shares	5	41.6%	1.6%	1,151	10.4%	0.5%	1	27.2%	0.4%	164	2.0%	0.1%
500-199 Shares	6	46.3%	1.8%	4,826	43.5%	2.0%	1	40.2%	0.7%	1,190	14.5%	0.4%
2000-4999 Shares	1	8.6%	0.3%	2,370	21.4%	1.0%	1	17.9%	0.3%	1,489	18.1%	0.5%
5000+ Shares	0	3.5%	0.1%	2,752	24.8%	1.1%	0	14.7%	0.2%	5,388	65.5%	1.8%
<b>Total Limit Orders</b>	<b>219</b>		<b>66.5%</b>	<b>171,542</b>		<b>71.5%</b>	<b>133</b>		<b>65.7%</b>	<b>235,296</b>		<b>77.3%</b>
<b>Grand Total</b>	<b>330</b>			<b>240,012</b>			<b>202</b>			<b>304,304</b>		

Appendix D. Summary of Executed Orders and Executed Shares  
Firms in Small Size Category

	Nasdaq						NYSE					
	Executed Orders (000's)			Executed Shares (000's)			Executed Orders (000's)			Executed Shares (000's)		
	Total	Percent of...		Total	Percent of...		Total	Percent of...		Total	Percent of...	
Ord.		Typ.	All Ords.		Ord.	Typ.		All Ords.	Ord.		Typ.	All Ords.
Market Orders												
100-499 Shares	19	48.1%	17.9%	3,888	13.4%	3.5%	14	50.3%	16.1%	2,851	9.7%	1.9%
500-199 Shares	17	42.4%	15.8%	13,578	46.9%	12.3%	11	38.2%	12.2%	9,169	31.2%	6.0%
2000-4999 Shares	3	8.1%	3.0%	7,707	26.6%	7.0%	2	8.4%	2.7%	6,407	21.8%	4.2%
5000+ Shares	1	1.5%	0.5%	3,787	13.1%	3.4%	1	3.1%	1.0%	10,941	37.3%	7.1%
Total Market Orders	39	100.0%	37.2%	28,960	100.0%	26.3%	28	100.0%	32.0%	29,367	100.0%	19.2%
Marketable Limit Orders												
100-499 Shares	10	27.6%	9.3%	2,044	4.3%	1.9%	7	28.2%	7.4%	1,368	2.4%	0.9%
500-199 Shares	17	48.4%	16.3%	14,172	29.5%	12.9%	9	38.9%	10.2%	8,113	14.5%	5.3%
2000-4999 Shares	6	16.2%	5.4%	12,639	26.4%	11.5%	4	17.8%	4.6%	10,508	18.7%	6.9%
5000+ Shares	3	7.8%	2.6%	19,105	39.8%	17.4%	4	15.1%	4.0%	36,060	64.3%	23.6%
At the Quote Limit Orders												
100-499 Shares	4	35.4%	3.5%	761	7.0%	0.7%	5	31.1%	5.7%	1,066	5.0%	0.7%
500-199 Shares	5	44.6%	4.4%	3,746	34.5%	3.4%	8	47.0%	8.6%	6,500	30.2%	4.2%
2000-4999 Shares	1	13.8%	1.4%	3,154	29.1%	2.9%	3	15.8%	2.9%	5,983	27.8%	3.9%
5000+ Shares	1	6.2%	0.6%	3,186	29.4%	2.9%	1	6.1%	1.1%	7,940	36.9%	5.2%
Inside the Quote Limit Orders												
100-499 Shares	6	33.7%	5.3%	1,219	6.7%	1.1%	6	29.3%	6.4%	1,099	2.7%	0.7%
500-199 Shares	8	46.8%	7.4%	6,365	34.9%	5.8%	8	40.1%	8.7%	7,149	17.4%	4.7%
2000-4999 Shares	2	12.8%	2.0%	4,692	25.7%	4.3%	3	17.3%	3.8%	8,630	21.0%	5.6%
5000+ Shares	1	6.8%	1.1%	5,948	32.6%	5.4%	3	13.3%	2.9%	24,301	59.0%	15.9%
Near the Quote Limit Orders												
100-499 Shares	1	29.4%	1.0%	234	5.8%	0.2%	0	24.0%	0.4%	66	1.3%	0.0%
500-199 Shares	2	49.2%	1.6%	1,441	36.0%	1.3%	1	44.3%	0.8%	643	13.0%	0.4%
2000-4999 Shares	1	16.3%	0.5%	1,379	34.5%	1.3%	0	15.9%	0.3%	619	12.5%	0.4%
5000+ Shares	0	5.1%	0.2%	948	23.7%	0.9%	0	15.9%	0.3%	3,626	73.2%	2.4%
Total Limit Orders	66		62.8%	81,036		73.7%	61		68.0%	123,674		80.8%
Grand Total	105			109,996			89			153,041		

Appendix E: NYSE Listing Requirements

Criteria	Requirements	Worldwide	North American Or Domestic
Distribution	Round-Lot Holders Public Shares Public Market Value IPO's, Carve-Outs, Spin-Offs & Affiliates All Other Listings	5,000 2.5 M \$100 M	2,000 1.1 M \$60 M \$100 M
Financial either	Alternative #1-Income Standard* Pre-Tax Income Most Recent Yr Each of the 2 Preceding Yrs  Aggregate for Last 3 Yrs Minimum Minimum in Each of the Most Recent 2 Yrs Minimum in the Most Recent Yr. (All 3 Yrs Must be Profitable)	\$100 M   \$25 M	\$2.5 M \$2.0 M OR \$6.5 M   \$4.5 M
or	Alternative #2-Cash Flow Standard* Market Cap. Revenues (Most Recent 12 Months Period) Aggregate Operating Cash Flow for Last 3 Yrs Each of the Most Recent 3 Yrs Minimum in Each of the Most Recent 2 Yrs	\$500 M \$200 M \$100 M  \$25 M	\$500 M \$200 M \$25 M Positive
or	Alternative #3-Global Market Capitalization Standard Market Cap. (Avg. of the Last 6 Months or IPO Valuation) Revenues (Most Recent Fiscal Yr)	\$1 B  \$100 M	\$1 B  \$100 M
or	Alternative #4 -- Affiliated Company Standard (for affiliates of NYSE listed companies in good standing with:) Market Cap. 12 Months Operating History – Not Necessarily Separate Corporate Entity Parent Company control (20% or more of equity) or significant influence No Specific Profit, Cashflow nor Revenue hurdle	Minimum \$500 M	Minimum \$500 M

Appendix F: Matched Pairs

Nasdaq Stock NYSE Stock	Ticker Symbols	Market Cap. (M)	Share Price	Return Volatility	Adj. Dollar Vol. (Mils)
<u>Very Large, close matches</u>					
3COM CORP	COMS	17991	51.28	0.0924	149.8
BEST BUY COMPANY INC	BBY	12841	62.44	0.0954	141.9
AMGEN INC	AMGN	64335	62.66	0.0695	296.0
CHASE MANHATTAN CORP NEW	CMB	60444	73.34	0.0594	286.6
APPLE COMPUTER INC	AAPL	15578	95.72	0.0825	194.0
TERADYNE INC	TER	15622	91.31	0.1053	136.2
COMCAST CORP	CMCSK	31977	36.59	0.0671	118.0
GAP INC	GPS	28099	33.00	0.0698	100.2
MCI WORLDCOM INC	WCOM	120696	42.16	0.0554	533.7
A T & T CORP	T	109740	34.34	0.0563	465.4
<u>Very Large, other matches</u>					
AMAZON COM INC	AMZN	18347	52.16	0.1444	147.8
L S I LOGIC CORP	LSI	18414	61.91	0.0945	152.4
APPLIED MATERIALS INC	AMAT	71875	94.97	0.0884	612.4
MICRON TECHNOLOGY INC	MU	41122	80.94	0.1053	460.6
BROADVISION INC	BVSN	12839	51.38	0.1621	235.3
NATIONAL SEMICONDUCTOR CORP	NSM	11267	65.69	0.1051	211.9
C M G I INC	CMGI	16498	61.00	0.1722	213.2
ADVANCED MICRO DEVICES INC	AMD	13101	88.56	0.1011	304.5
CIENA CORP	CIEN	19577	139.88	0.1512	515.8
CORNING INC	GLW	51900	212.13	0.0795	426.8
CISCO SYSTEMS INC	CSCO	443837	64.41	0.0665	1391.4
LUCENT TECHNOLOGIES INC	LU	187329	59.66	0.0736	630.2
DELL COMPUTER CORP	DELL	116485	45.03	0.0795	652.4
NORTEL NETWORKS CORP	NT	161734	59.22	0.0821	540.7
INTEL CORP	INTC	424747	127.09	0.0644	1682.0
INTERNATIONAL BUSINESS MACH	IBM	215674	119.75	0.0532	726.1
J D S UNIPHASE CORP	JDSU	65963	110.59	0.1010	1028.2
HEWLETT PACKARD CO	HWP	130019	127.88	0.0644	481.7
MICROSOFT CORP	MSFT	362284	68.84	0.0613	1761.9
CITIGROUP INC	C	216029	64.00	0.0595	403.5
NEXTEL COMMUNICATIONS INC	NXTL	20721	57.34	0.0941	241.5
ELECTRONIC DATA SYSTEMS COR	EDS	20254	43.06	0.0666	255.1
ORACLE CORP	ORCL	234701	82.69	0.0975	1065.3
AMERICA ONLINE INC	AOL	123621	54.84	0.1090	423.5

Nasdaq Stock NYSE Stock	Ticker Symbols	Market Cap. (M)	Share Price	Return Volatility	Adj. Dollar Vol. (Mils)
<u>Very Large, other matches (continued)</u>					
P M C SIERRA INC	PMCS	27377	187.66	0.1139	668.5
MERRILL LYNCH & CO INC	MER	39563	108.06	0.0697	241.9
QUALCOMM INC	QCOM	58797	79.34	0.1161	1090.6
MOTOROLA INC	MOT	63515	34.78	0.0717	509.3
RAMBUS INC	RMBS	5594	233.72	0.1458	702.9
GENERAL MOTORS CORP	GMH	13532	99.88	0.0652	266.1
SIEBEL SYSTEMS INC	SEBL	28799	144.28	0.1075	332.9
ANALOG DEVICES INC	ADI	33049	94.69	0.0999	186.5
SUN MICROSYSTEMS INC	SUNW	142628	89.91	0.0786	783.7
E M C CORP MA	EMC	141905	68.94	0.0712	370.4
TELLABS INC	TLAB	27577	67.34	0.0823	162.1
COMPUTER ASSOCIATES INTL I	CA	31853	59.09	0.0705	124.2
VERITAS SOFTWARE CORP	VRTS	54082	135.66	0.0974	383.0
TIME WARNER INC	TWX	95378	80.88	0.0605	307.6
YAHOO INC	YHOO	77772	143.16	0.1166	757.4
PROCTER & GAMBLE CO	PG	74292	56.53	0.0565	390.2
<u>Large, close matches</u>					
AMERICAN POWER CONVERSION CO	APCC	7762	40.13	0.0767	49.4
AVON PRODUCTS INC	AVP	10149	41.84	0.0766	38.0
COMVERSE TECHNOLOGY INC	CMVT	13523	86.97	0.0810	115.6
SEAGATE TECHNOLOGY	SEG	13574	65.03	0.0898	112.7
CUBIST PHARMACEUTICALS INC	CBST	1045	39.22	0.1346	6.9
TRITON ENERGY LTD	OIL	1161	32.53	0.1075	6.8
EMMIS COMMUNICATIONS CORP	EMMS	1524	37.16	0.0876	6.4
BARRETT RESOURCES CORP	BRR	1177	36.13	0.0807	6.7
GILEAD SCIENCES INC	GILD	2962	66.47	0.1046	17.8
TEKTRONIX INC	TEK	2822	59.72	0.0837	14.4
LAM RESH CORP	LRCX	5198	41.78	0.1184	96.5
S C I SYSTEMS INC	SCI	5468	37.91	0.0988	89.1
MEDICAL MANAGER CORP NEW	MMGR	1197	29.38	0.1049	7.5
STATION CASINOS INC	STN	1211	28.72	0.0979	5.4
MEDQUIST INC	MEDQ	1496	42.22	0.0818	15.4
TITAN CORP	TTN	1795	39.41	0.0903	17.0
NATIONAL BANCORP AK	NBAK	1169	38.69	0.0492	0.4
IDEX CORP	IEX	995	33.53	0.0560	0.4
OUTBACK STEAKHOUSE INC	OSSI	2483	31.84	0.0591	9.3
HARRIS CORP	HRS	2546	31.91	0.0570	7.2
SKY FINANCIAL GROUP INC	SKYF	1427	18.47	0.0442	1.5
UNITED ASSET MGMT CORP	UAM	1184	20.16	0.0444	2.2

Nasdaq Stock NYSE Stock	Ticker Symbols	Market Cap. (M)	Share Price	Return Volatility	Adj. Dollar Vol. (Mils)
<u>Large, close matches (continued)</u>					
SOVEREIGN BANCORP INC	SVRN	1766	7.83	0.0652	5.2
HOMESTAKE MINING CO	HM	1823	7.03	0.0683	6.6
WASHINGTON FEDERAL INC	WFSL	1038	19.84	0.0379	3.5
MARK IV INDUSTRIES INC	IV	993	21.22	0.0497	3.4
WESTERN WIRELESS CORP	WWCA	4023	56.88	0.0828	34.8
CALPINE CORP	CPN	3175	50.50	0.0874	49.4
<u>Large, other matches</u>					
AMERITRADE HOLDING CORP	AMTD	2063	13.03	0.1862	12.2
OCEAN ENERGY INC	OEI	2352	14.09	0.0926	9.9
CENTENNIAL CELLULAR CORP	CYCL	1642	17.41	0.1044	0.1
OMNICARE INC	OCR	1546	16.84	0.0887	4.5
CREDENCE SYSTEMS CORP	CMOS	3083	62.09	0.1158	33.7
COOPER CAMERON CORP	CAM	3584	66.38	0.0923	50.9
HARMONIC INC	HLIT	3236	56.69	0.1305	84.5
SMITH INTERNATIONAL INC	SII	3322	67.88	0.0982	69.2
I D E C PHARMACEUTICALS CORP	IDPH	4451	100.22	0.1113	68.2
B J SERVICES CO	BJS	4908	64.69	0.0963	103.7
KOPIN CORP	KOPN	2701	85.91	0.1249	37.1
SHARED MEDICAL SYSTEMS CORP	SMS	1881	69.94	0.1051	63.8
L H S GROUP INC	LHSG	2126	35.84	0.1001	1.0
I C N PHARMACEUTICALS INC N	ICN	2582	33.59	0.0981	13.4
MACROVISION CORPORATION	MVSN	2657	66.00	0.1181	15.7
ROBERT HALF INTERNATIONAL I	RHI	5511	61.44	0.0919	16.7
MERCURY INTERACTIVE CORP	MERQ	6958	87.47	0.1147	83.7
LEHMAN BROTHERS HOLDINGS IN	LEH	10257	85.53	0.0811	82.3
MYRIAD GENETICS INC	MYGN	1334	127.63	0.1580	62.5
PROVIDIAN FINANCIAL CORP	PVN	13221	93.25	0.0941	50.2
NETEGRITY INC	NETE	1216	62.91	0.1907	14.0
THREE FIVE SYSTEMS INC	TFS	1426	79.00	0.1085	20.2
NEWPORT CORP	NEWP	2235	79.34	0.1142	74.1
LEXMARK INTERNATIONAL GROUP	LXK	9045	70.81	0.0880	77.0
NOVELLUS SYSTEMS INC	NVLS	7197	55.09	0.1145	76.7
CYPRESS SEMICONDUCTOR CORP	CY	5621	51.19	0.0846	67.5
REXALL SUNDOWN INC	RXSD	1525	23.84	0.0977	1.4
TELEGLOBE INC	TGO	2756	22.84	0.0793	1.4

Nasdaq Stock NYSE Stock	Ticker Symbols	Market Cap. (M)	Share Price	Return Volatility	Adj. Dollar Vol. (Mils)
<u>Large, other matches (continued)</u>					
S I CORP SAFEGUARD SCIENTIFICS INC	SONE SFE	2061 4384	38.03 41.69	0.1538 0.1303	27.7 24.8
S D L INC TEXAS INSTRUMENTS INC	SDLI TXN	19130 131684	249.91 83.75	0.1206 0.0717	804.0 337.0
SEMTECH CORP TIMES MIRROR CO NEW	SMTC TMC	2195 3898	67.31 93.41	0.1064 0.0916	17.1 16.8
SYBASE INC U S AIRWAYS GROUP INC	SYBS U	1823 2981	20.34 41.72	0.0999 0.1017	19.7 19.5
SYMANTEC CORP KANSAS CITY SOUTHN INDS INC	SYMC KSU	4254 8362	71.63 75.63	0.0909 0.0754	30.0 30.3
<u>Middle, close matches</u>					
ADEPT TECHNOLOGY INC VERITAS D G C INC	ADTK VTS	273 537	27.84 24.94	0.1155 0.1217	3.2 3.1
ALEXION PHARMACEUTICALS INC ATWOOD OCEANICS INC	ALXN ATW	704 702	46.84 51.25	0.1226 0.0958	3.7 4.1
CAMBRIDGE TECHNOLOGY PRTNRS NEWPARK RESOURCES INC	CATP NR	480 617	7.69 8.84	0.1173 0.1037	1.4 1.2
DREYERS GRAND ICE CREAM INC HOUSTON EXPLORATION CO	DRYR THX	640 573	22.78 23.69	0.0726 0.0671	0.6 0.9
EMCOR GROUP INC SMITH A O CORP	EMCG AOS	218 308	20.94 21.16	0.0516 0.0561	0.4 0.4
FIRST FINANCIAL BANCORP SOUTHERN UNION CO NEW	FFBC SUG	860 800	18.47 16.50	0.0461 0.0480	0.2 0.2
FIRST SENTINEL BANCORP INC ROLLINS TRUCK LEASING CORP	FSLA RLC	298 532	8.30 9.31	0.0440 0.0467	0.4 0.5
GOLD BANC CORP INC SYSTEMAX INC	GLDB SYX	242 213	6.41 5.94	0.0732 0.0911	0.1 0.1
GUILFORD PHARMACEUTICALS INC NUEVO ENERGY CO	GLFD NEV	357 379	15.25 20.41	0.0969 0.1080	4.1 4.2
LITTELFUSE INC BRIGGS & STRATTON CORP	LFUS BGG	836 953	42.72 41.06	0.0567 0.0542	8.8 9.0
MADISON GAS & ELECTRIC CO TRIARC COMPANIES INC	MDSN TRY	331 421	20.28 21.41	0.0410 0.0469	0.3 0.3
MICHAEL FOODS INC A B M INDUSTRIES INC	MIKL ABM	466 550	23.59 24.59	0.0467 0.0470	0.4 0.4
MICROS SYSTEMS INC ALASKA AIRGROUP INC	MCRS ALK	503 832	29.16 31.47	0.0731 0.0687	6.8 7.6

Nasdaq Stock NYSE Stock	Ticker Symbols	Market Cap. (M)	Share Price	Return Volatility	Adj. Dollar Vol. (Mils)
<u>Middle, close matches (continued)</u>					
MODINE MANUFACTURING CO	MODI	645	22.00	0.0452	1.4
FERRO CORP	FOE	789	22.38	0.0494	1.5
O CHARLEYS INC	CHUX	244	15.66	0.0694	0.4
D V I INC	DVI	234	16.41	0.0743	0.4
OHIO CASUALTY CORP	OCAS	670	11.16	0.0469	1.7
LA Z BOY INC	LZB	788	15.09	0.0481	1.8
P F F BANCORP INC	PFFB	213	15.97	0.0536	0.2
BRUSH WELLMAN INC	BW	283	17.28	0.0543	0.3
PHARMACYCLICS INC	PCYC	967	60.59	0.1305	6.1
ADMINISTAFF INC	ASF	820	61.06	0.1165	8.1
PRIMA ENERGY CORP	PENG	364	42.94	0.0587	3.9
NACCO INDUSTRIES INC	NC	242	37.16	0.0623	3.8
RIGGS NATIONAL CORP WASH D C	RIGS	395	13.94	0.0508	0.7
LILLY INDUSTRIES INC	LI	338	14.75	0.0606	0.6
SELECTIVE INSURANCE GROUP	SIGI	501	19.22	0.0445	0.8
CARPENTER TECHNOLOGY CORP	CRS	464	21.09	0.0460	0.8
STERLING BANCSHARES INC	SBIB	287	11.00	0.0515	0.2
MEDICAL ASSURANCE INC	MAI	257	11.44	0.0567	0.2
TRIAD GUARANTY INC	TGIC	273	20.47	0.0767	0.4
LANDAMERICA FINANCIAL GROUP	LFG	324	23.03	0.0725	0.4
VETERINARY CENTERS OF AMERIC	VCAI	299	13.66	0.0603	0.7
WEBB DELAWARE CORP	WBB	278	15.22	0.0572	0.9
WILSONS LEATHER EXPERTS	WLSN	281	16.84	0.0630	0.4
VAIL RESORTS INC	MTN	476	17.47	0.0639	0.4
YOUNG BROADCASTING INC	YBTVA	268	23.84	0.0777	0.8
MIDWEST EXPRESS HOLDINGS IN	MEH	313	22.06	0.0617	0.9
<u>Middle, other matches</u>					
A C T MANUFACTURING INC	ACTM	580	34.72	0.1173	9.7
SOUTHWEST SECURITIES GROUP	SWS	386	33.00	0.1328	8.0
AMERICAN SUPERCONDUCTOR CORP	AMSC	722	46.03	0.1334	18.6
KEITHLEY INSTRUMENTS INC	KEI	447	49.88	0.1068	18.6
AVT CORPORATION	AVTC	246	7.78	0.1111	3.5
N S GROUP INC	NSS	397	18.41	0.1001	3.7
BEN & JERRYS HOMEMADE INC	BJICA	268	43.66	0.0877	0.2
PARK ELECTROCHEMICAL CORP	PKE	280	26.81	0.0768	0.5
BRIGHTPOINT INC	CELL	658	11.84	0.1191	3.5
FOUNDATION HEALTH SYSTEMS I	FHS	1379	11.59	0.1020	3.7

Nasdaq Stock NYSE Stock	Ticker Symbols	Market Cap. (M)	Share Price	Return Volatility	Adj. Dollar Vol. (Mils)
<u>Middle, other matches (continued)</u>					
C T C COMMUNICATIONS GROUP I	CPTL	515	35.72	0.1428	4.0
COOPER COMPANIES INC	COO	528	37.59	0.0819	3.5
CARDIODYNAMICS INTL CORP	CDIC	291	6.91	0.1566	1.0
GENERAL CABLE CORP DEL NEW	BGC	290	8.44	0.1036	1.2
CENTURY SOUTH BANKS INC	CSBI	269	19.59	0.0493	0.1
DELTIC TIMBER CORP	DEL	267	21.44	0.0461	0.1
COCA COLA BOTTLING CO CONS	COKE	305	47.69	0.0300	0.1
C T G RESOURCES INC	CTG	333	38.41	0.0334	0.5
CONCURRENT COMPUTER CORP NEW	CCUR	638	11.84	0.1352	4.9
MODIS PROFESSIONAL SERVICES	MPS	952	9.94	0.1035	5.0
CONDUCTUS INC	CDTS	274	23.84	0.2272	24.7
CABLETRON SYSTEMS INC	CS	4062	22.47	0.1173	23.1
CYTOGEN CORP	CYTO	567	7.80	0.2068	13.4
RITE AID CORP	RAD	1987	7.72	0.1007	16.5
DATA BROADCASTING CORP	DBCC	553	6.06	0.1645	1.1
CHESAPEAKE ENERGY CORP	CHK	513	5.34	0.1389	2.9
GENE LOGIC INC	GLGC	927	36.41	0.1914	53.1
WEATHERFORD INTL INC NEW	WFT	4364	40.28	0.1038	55.2
GREAT PLAINS SOFTWARE INC	GPSI	408	23.47	0.0916	25.4
BOSTON SCIENTIFIC CORP	BSX	9784	23.59	0.0813	26.9
HALL KINION & ASSOCIATES INC	HAKI	358	27.72	0.1170	5.1
SWIFT ENERGY CO	SFY	585	26.91	0.0840	5.3
HARBINGER CORP	HRBC	773	19.28	0.1452	5.7
POLAROID CORP	PRD	773	18.84	0.0754	5.8
IMMUNOMEDICS INC	IMMU	935	18.97	0.1626	7.7
LANDS END INC	LE	880	29.16	0.0985	7.2
IMPATH INC	IMPH	369	48.22	0.0938	3.6
SHAW GROUP INC	SGR	717	47.38	0.0912	4.5
INDUSTRI MATEMATIK INTL CORP	IMIC	203	6.41	0.1641	0.2
GENERAL DATACOMM INDS INC	GDC	111	5.53	0.1453	0.1
INFORMATION ARCHITECTS CORP	IARC	254	8.72	0.2116	6.1
CAREMARK RX INC	CMX	1264	6.22	0.1303	5.1
INTERNATIONAL FIBERCOM INC	IFCI	566	18.56	0.1460	7.7
FURNITURE BRANDS INTL INC	FBN	758	15.38	0.0912	6.7
IRVINE SENSORS CORP	IRSN	234	5.55	0.1725	2.9
WESTERN DIGITAL CORP	WDC	485	4.28	0.1287	3.6
IRWIN FINANCIAL CORP	IRWN	319	15.22	0.0616	0.1
DETROIT DIESEL CORP	DDC	387	15.59	0.0554	0.2

Nasdaq Stock NYSE Stock	Ticker Symbols	Market Cap. (M)	Share Price	Return Volatility	Adj. Dollar Vol. (Mils)
<u>Middle, other matches (continued)</u>					
M G I PHARMA INC	MOGN	383	24.84	0.1360	1.6
M S C INDUSTRIAL DIRECT INC	MSM	726	21.34	0.1161	2.0
MAPINFO CORP	MAPS	350	38.34	0.0785	2.5
BENCHMARK ELECTRONICS INC	BHE	618	37.97	0.1052	2.2
MAVERICK TUBE CORP	MAVK	549	30.72	0.1069	3.2
AVISTA CORP	AVA	878	23.56	0.1106	3.4
MEMBERWORKS INC	MBRS	475	29.28	0.1387	1.6
DRIL QUIP INC	DRQ	722	41.91	0.1054	1.6
N C O GROUP INC	NCOG	642	25.06	0.0940	2.4
GEORGIA GULF CORP	GGC	720	23.09	0.0828	3.9
NANOMETRICS INC	NANO	342	30.31	0.1089	2.2
H S RESOURCES INC	HSE	581	30.78	0.0772	2.2
O S I PHARMACEUTICALS INC	OSIP	420	15.91	0.1461	1.5
I T T EDUCATIONAL SERVICES	ESI	471	19.06	0.0888	1.4
OBJECTIVE SYSTEMS INTEGRATOR	OSII	351	9.55	0.1624	2.3
GENESCO INC	GCO	349	16.03	0.0879	2.1
PHARMOS CORP	PARS	208	3.97	0.1396	1.0
TOTAL RENAL CARE HLDGS INC	TRL	320	3.91	0.1190	0.6
PROFIT RECOVERY GROUP INTL I	PRGX	779	15.72	0.0991	23.5
ANNTAYLOR STORES CORP	ANN	965	31.41	0.0942	15.8
PROJECT SOFTWARE & DEV INC	PSDI	532	24.41	0.1361	1.6
AVIS RENT A CAR	AVI	589	18.88	0.0880	1.5
S B S TECHNOLOGIES INC	SBSE	242	36.97	0.1155	1.2
ROGERS CANTEL MOBILE COMMS	RCN	539	30.25	0.0852	1.3
SCHOLASTIC CORP	SCHL	895	55.38	0.0562	1.4
ROPER INDUSTRIES INC NEW	ROP	1063	34.88	0.0651	1.5
SCICLONE PHARMACEUTICALS INC	SCLN	350	11.13	0.1662	4.0
SENSORMATIC ELECTRONICS COR	SRM	1334	17.41	0.0951	3.7
SPORTSLINE COM INC	SPLN	446	16.91	0.1779	2.6
GENERAL SEMICONDUCTOR INC	SEM	645	17.41	0.0827	2.9
STARBASE CORP	SBAS	249	5.91	0.2426	2.2
PARKER DRILLING CO	PKD	441	5.59	0.0954	2.6
SYSTEMS & COMPUTER TECHNOLOG	SCTC	627	19.28	0.1207	1.8
ARGOSY GAMING CO	AGY	490	17.28	0.0890	1.8
TRANSKARYOTIC THERAPIES INC	TKTX	969	42.72	0.1348	9.6
TIMBERLAND CO	TBL	1278	78.53	0.0858	9.8
TRICORD SYSTEMS INC	TRCD	337	13.88	0.3081	2.6
STARTEK INC	SRT	884	63.28	0.1261	2.1

Nasdaq Stock NYSE Stock	Ticker Symbols	Market Cap. (M)	Share Price	Return Volatility	Adj. Dollar Vol. (Mils)
<u>Middle, other matches (continued)</u>					
ZIXIT CORP	ZIXI	588	35.53	0.1661	10.4
PRIDE INTERNATIONAL INC	PDE	1485	24.16	0.1084	9.1
ZOLL MEDICAL CORP	ZOLL	403	46.59	0.1091	3.9
COLE KENNETH PRODUCTIONS IN	KCP	379	34.44	0.0730	5.5
ZYGO CORP	ZIGO	782	54.34	0.1610	9.2
TALBOTS INC	TLB	1723	54.72	0.0847	10.9
<u>Small, close matches</u>					
AMTRAN INC	AMTR	177	14.66	0.0711	0.1
STEWART INFORMATION SVCS CO	STC	205	15.13	0.0759	0.1
APPLIED INNOVATION INC	AINN	128	8.25	0.1255	0.4
AVIATION SALES CO	AVS	115	7.66	0.1173	0.5
ARCTIC CAT INC	ACAT	190	10.91	0.0440	0.3
MARCUS CORP	MCS	197	11.19	0.0538	0.2
BLUE WAVE SYSTEMS INC	BWSI	195	12.44	0.1485	2.7
PEDIATRIX MEDICAL GROUP	PDX	167	10.66	0.1333	2.4
CADMUS COMMUNICATIONS CORP	CDMS	80	8.97	0.0628	0.1
AMCAST INDUSTRIAL CORP	AIZ	82	9.16	0.0600	0.1
COINSTAR INC	CSTR	185	9.17	0.1128	0.2
UNITED AUTO GROUP INC	UAG	197	9.13	0.1107	0.4
FIRST WASHINGTON BANC RP INC	FWWB	163	14.66	0.0486	0.3
ESTERLINE TECHNOLOGIES CORP	ESL	257	14.78	0.0639	0.3
INTERMET CORP	INMT	156	6.16	0.0698	0.2
COMFORT SYSTEMS USA INC	FIX	207	5.44	0.0777	0.2
L S I INDUSTRIES INC	LYTS	159	15.53	0.0543	0.6
QUANEX CORP	NX	215	15.09	0.0593	0.6
METRO INFORMATION SERVICES I	MISI	135	8.97	0.0968	0.4
M S C SOFTWARE CORP	MNS	139	10.03	0.0806	0.4
SAVOIR TECHNOLOGY GROUP INC	SVTG	114	8.39	0.0791	0.3
CONSOLIDATED GRAPHICS INC	CGX	163	10.34	0.0902	0.3
SPACELABS MEDICAL INC	SLMD	113	11.91	0.0544	0.3
LYDALL INC	LDL	156	9.91	0.0641	0.3
SS & C TECHNOLOGIES INC	SSNC	72	4.45	0.1074	0.1
CHART INDUSTRIES INC	CTI	99	4.19	0.0958	0.1
<u>Small, other matches</u>					
3 D SYSTEMS CORP DEL	TDSC	176	14.81	0.0910	3.0
PIONEER NATURAL RESOURCES C	PXD	1368	13.59	0.0854	3.1
3D0 CO THE	THDO	189	5.30	0.1173	6.4
ABERCROMBIE & FITCH CO	ANF	926	9.09	0.0922	8.1

Nasdaq Stock NYSE Stock	Ticker Symbols	Market Cap. (M)	Share Price	Return Volatility	Adj. Dollar Vol. (Mils)
<b>Small, other matches (continued)</b>					
4FRONT TECHNOLOGIES INC	FFTI	127	10.59	0.1211	5.1
FEDERAL MOGUL CORP	FMO	735	9.97	0.0887	6.0
A C T NETWORKS INC	ANET	155	14.75	0.1237	5.5
APRIA HEALTHCARE GROUP INC	AHG	621	11.94	0.1163	5.8
ADVANCED AERODYNAMICS STRUC	AASI	24	3.42	0.1280	0.0
SIMULA INC	SMU	24	2.31	0.1266	0.0
AFTERMARKET TECHNOLOGY CORP	ATAC	115	5.59	0.1121	0.5
SOLA INTERNATIONAL INC	SOL	122	4.94	0.0926	0.4
ANDOVER BANCORP INC DEL	ANDB	180	28.31	0.0411	0.3
C P I CORP	CPY	217	21.84	0.0630	0.3
ANIKA THERAPEUTICS INC	ANIK	19	1.88	0.1032	0.3
MAGELLAN HEALTH SERVICES IN	MGL	75	2.34	0.1240	0.3
ARIEL CORP	ADSP	46	3.50	0.7594	0.4
LABORATORY CORP AMERICA HL	LH	8379	65.06	0.8687	8.3
ASHTON TECHNOLOGY GROUP INC	ASTN	100	3.61	0.1890	0.4
RANGE RESOURCES CORP	RRC	107	2.84	0.1331	0.5
B E I TECHNOLOGIES INC	BEIQ	136	18.22	0.1085	0.2
CRYOLIFE INC	CRY	250	20.28	0.0780	0.3
BIO LOGIC SYS CORP	BLSC	24	5.97	0.1319	0.1
PILLOWTEX CORP	PTX	61	4.19	0.1037	0.1
BITSTREAM INC	BITS	57	7.38	0.1845	0.6
ENTRADE INC	ETA	76	8.56	0.1663	0.7
CASINO DATA SYSTEMS	CSDS	80	4.34	0.1318	0.2
B M C INDUSTRIES INC MN	BMC	113	4.09	0.1177	0.3
COINMACH LAUNDRY CORP	WDRY	178	13.72	0.1129	2.4
REEBOK INTERNATIONAL LTD	RBK	785	13.91	0.0864	2.5
COLLAGENEX PHARMACEUTICALS I	CGPI	90	10.41	0.1326	0.2
C B RICHARD ELLIS SERVICES	CBG	197	9.47	0.1015	0.2
COMMUNICATIONS SYSTEM INC	CSII	151	17.16	0.0723	0.3
U R S CORP NEW	URS	234	14.88	0.0662	0.3
COMPU DAWN INC	MYTN	159	15.94	0.2234	3.0
CIBER INC	CBR	1009	17.03	0.0951	2.5
COMTECH TELECOMMUNICATIONS C	CMTL	101	14.00	0.1426	1.0
SAGA SYSTEMS INC	AGS	425	14.81	0.1262	1.0
CRAFTMADE INTERNATIONAL INC	CRFT	38	6.19	0.0850	0.1
ACCEPTANCE INSURANCE COS IN	AIF	71	5.03	0.0815	0.1
CREATIVE HOST SERVICES INC	CHST	157	27.38	0.2405	3.7
NATIONAL DISCOUNT BRKRS GRP	NDB	471	27.84	0.2638	3.2

Nasdaq Stock NYSE Stock	Ticker Symbols	Market Cap. (M)	Share Price	Return Volatility	Adj. Dollar Vol. (Mils)
<u>Small, other matches (continued)</u>					
DATA RACE INC	RACE	169	7.36	0.2688	9.3
HEALTHSOUTH CORP	HRC	2865	7.38	0.0936	11.1
DATA SYSTEMS & SOFTWARE INC	DSSI	41	5.47	0.1181	0.3
MERIDIAN RESOURCE CORP	TMR	235	5.06	0.1011	0.3
DIANON SYSTEMS INC	DIAN	169	23.69	0.0727	1.8
REX STORES CORP	RSC	194	21.06	0.0947	2.5
EAGLE BANCSHARES INC	EBSI	71	12.84	0.0553	0.0
LINDSAY MANUFACTURING CO	LNN	226	18.13	0.0639	0.0
ECLIPSE SURGICAL TECHNOLOGIE	ESTI	134	4.47	0.1455	0.4
E E X CORP	EEX	216	5.03	0.1115	0.4
EPICOR SOFTWARE CORP	EPIC	146	3.53	0.1302	0.6
C K E RESTAURANTS INC	CKR	158	3.09	0.1060	0.5
EPIMMUNE INC	EPMN	50	6.81	0.3137	0.2
BRILLIANCE CHINA AUTOMOTIVE	CBA	922	17.75	0.3536	0.6
EQUINOX SYSTEMS INC	EQNX	30	5.59	0.1028	0.2
BOYD GAMING CORP	BYD	342	5.47	0.0885	0.2
EURONET SERVICES INC	EEFT	124	7.53	0.1460	0.0
REVLON INC	REV	139	6.94	0.1229	0.2
F P I C INSURANCE GROUP INC	FPIC	148	15.66	0.0933	1.1
DOLLAR THRIFTY AUTOMOTIVE G	DTG	436	17.94	0.0884	1.1
GENERAL BINDING CORP	GBND	105	7.86	0.0944	0.1
ALPINE GROUP INC	AGI	98	6.66	0.0674	0.1
GENUS INC	GGNS	153	8.16	0.1869	1.0
DOT HILL SYSTEMS CORP	HIL	255	10.69	0.1339	0.8
GENZYME CORP	GZTR	159	5.56	0.1285	1.0
HA LO INDUSTRIES INC	HMK	247	5.03	0.1121	0.8
GREEN MOUNTAIN COFFEE INC	GMCR	68	20.13	0.0786	0.2
FIRST REPUBLIC BANK S F	FRC	176	18.78	0.0549	0.2
GROUP 1 SOFTWARE INC NEW	GSOFT	88	16.31	0.1212	0.1
GROUP 1 AUTOMOTIVE INC	GPI	255	11.91	0.0885	0.1
HAGGAR CORP	HGGR	74	11.22	0.0407	0.1
DISCOUNT AUTO PARTS INC	DAP	157	9.41	0.0718	0.1
INFONAUTICS INC	INFO	49	4.03	0.2225	0.3
TRUMP HOTELS & CASINO RESRT	DJT	66	2.97	0.1163	0.2
INFORMATION RESOURCE ENGNRIN	IREG	121	18.22	0.1590	1.4
GUESS INC	GES	783	18.13	0.1197	1.6
INTERSTATE NATL DEALER SVCS	ISTN	25	5.36	0.0765	0.0
ELSCINT LIMITED	ELT	103	6.38	0.0687	0.0

Nasdaq Stock NYSE Stock	Ticker Symbols	Market Cap. (M)	Share Price	Return Volatility	Adj. Dollar Vol. (Mils)
<u>Small, other matches (continued)</u>					
LASER PACIFIC MEDIA CORP	LPAC	36	4.61	0.2595	0.2
BROWN & SHARPE MFG CO	BNS	41	3.22	0.0961	0.1
LESCO INC OHIO	LSCO	131	15.44	0.0614	0.1
GUEST SUPPLY INC	GSY	122	19.00	0.0602	0.4
LOGILITY INC	LGTY	57	4.28	0.1815	0.1
CHYRON CORP	CHY	91	2.72	0.2023	0.2
M H MEYERSON & CO INC	MHMY	29	4.48	0.4148	0.2
LODGIAN INC	LOD	84	2.97	0.1183	0.2
M S CARRIERS INC	MSCA	199	17.03	0.0745	1.0
OCEANEERING INTERNATIONAL I	OII	455	19.31	0.0836	1.1
MATHSOFT INC	MATH	29	2.80	0.1499	0.1
CAPITAL SENIOR LIVING CORP	CSU	49	2.50	0.0851	0.1
MINNTECH CORP	MNTX	54	7.91	0.0728	0.2
WORLD FUEL SERVICES CORP	INT	102	8.41	0.0732	0.2
NETSMART TECHNOLOGIES INC	NTST	20	5.56	0.2659	0.1
SITEL CORP	SWW	390	5.69	0.1338	0.6
ODETICS INC	ODETA	105	12.97	0.1140	0.2
JACKPOT ENTERPRISES INC	J	116	13.44	0.0772	0.4
ON TECHNOLOGY CORP	ONTC	55	3.84	0.1723	0.3
BENTON OIL & GAS CO	BNO	84	2.84	0.1392	0.6
ONYX PHARMACEUTICALS INC	ONXX	180	12.69	0.1639	4.6
UNITED RENTALS INC	URI	1268	17.56	0.0980	4.7
PHARMANETICS INC	PHAR	119	15.81	0.1032	0.2
BUCKLE INC	BKE	260	12.22	0.0994	0.1
POINT WEST CAPTIAL CORP	PWCC	12	3.64	0.2124	0.0
AMERICAN SKIING CO	SKI	30	1.94	0.1103	0.0
PRECISION OPTICS CORP INC	POCI	122	12.41	0.2516	1.9
MID ATLANTIC MEDICAL SVCS I	MME	585	11.69	0.1022	1.8
PROPHET 21 INC	PXXI	47	12.94	0.1074	0.1
BURNS INTERNATIONAL SVCS CO	BOR	223	11.22	0.0785	0.1
PURE WORLD INC	PURW	24	2.88	0.1163	0.0
CARSON INC	CIC	41	4.16	0.1184	0.0
R F MONOLITHICS INC	RFMI	68	11.22	0.1082	0.1
MATERIAL SCIENCES CORP	MSC	166	10.69	0.0764	0.1
R M H TELESERVICES INC	RMHT	66	7.84	0.1330	0.0
B W A Y CORP	BY	68	7.16	0.0894	0.0
RENTRAK CORP	RENT	41	3.94	0.1126	0.1
ROUGE INDUSTRIES INC	ROU	54	3.66	0.0852	0.1

Nasdaq Stock NYSE Stock	Ticker Symbols	Market Cap. (M)	Share Price	Return Volatility	Adj. Dollar Vol. (Mils)
<u>Small, other matches (continued)</u>					
RESOURCE BANCSHARES MORT GP	RBMG	85	4.53	0.1019	0.3
AVIALL INC NEW	AVL	83	4.53	0.0724	0.2
ROBINSON NUGENT INC	RNIC	60	11.81	0.0887	0.1
SUPERIOR TELECOM INC	SUT	221	11.31	0.0898	0.2
SHARPER IMAGE CORP	SHRP	152	12.66	0.3102	0.3
I S P A T INTERNATIONAL N V	IST	235	8.59	0.1136	0.4
SHELDAHL COMPANY	SHEL	51	4.34	0.1163	0.1
BIRMINGHAM STEEL CORP	BIR	102	3.38	0.1002	0.1
SHOE CARNIVAL INC IN	SCVL	86	6.64	0.0882	0.5
I M C O RECYCLING INC	IMR	106	6.34	0.0698	0.4
SIEBERT FINANCIAL CORP	SIEB	194	8.47	0.3170	0.1
CASH AMERICA INTERNATIONAL	PWN	218	8.50	0.0878	0.2
SPECTRANETICS CORP	SPNC	125	5.38	0.1092	0.2
NATIONAL STEEL CORP	NS	215	5.16	0.0784	0.2
SPIRE CORP	SPIR	20	6.00	0.1533	0.1
TITAN INTERNATIONAL INC ILL	TWI	128	6.16	0.0833	0.1
STARTEC GLOBAL COM CORP	STGC	154	11.38	0.1399	1.8
UNIT CORP	UNT	405	11.84	0.0881	1.8
STRATASYS INC	SSYS	37	6.03	0.1028	0.1
DONNA KARAN INTERNATIONAL	DK	138	6.34	0.0833	0.1
STYLECLICK COM INC	IBUY	76	9.78	0.1233	0.4
EXIDE CORP	EX	196	9.28	0.1094	0.5
SYMIX SYSTEMS INC	SYMX	77	10.22	0.1202	0.1
POLYMER GROUP INC	PGI	314	9.78	0.0932	0.3
TELULAR CORP	WRLS	151	12.09	0.5141	2.5
STORAGE TECHNOLOGY CORP	STK	1223	12.25	0.0915	2.5
TIER TECHNOLOGIES INC	TIER	62	5.59	0.1078	0.4
COMPUTER TASK GROUP INC	TSK	137	6.53	0.0846	0.3
TROPICAL SPORTSWEAR INTL COR	TSIC	166	21.81	0.1033	0.5
NORTEK INC	NTK	258	23.34	0.0646	0.6
U S ENERGY SYSTEMS INC	USEY	34	5.48	0.1053	0.4
INPUT OUTPUT INC	IO	363	6.94	0.0838	0.5
UROCOR INC	UCOR	41	4.19	0.0910	0.1
TYLER TECHNOLOGIES INC	TYL	173	3.97	0.1062	0.1
VANS INC	VANS	185	13.47	0.0877	1.0
U C A R INTERNATIONAL INC	UCR	598	13.25	0.0956	0.9
VARI L INC	VARL	96	13.53	0.1307	1.1
M E M C ELECTRONIC MATERIAL	WFR	1236	17.72	0.1221	1.0